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No. 1705

INSTRUCTIONS FOR MOUNTING, USING, AND CARING FOR

MORTAR CARRIAGES

MODEL OF 1896 MI
AND MODEL OF 1896 MII

FOR

12-INCH MORTARS

MODEL OF 1890 MI

(*TWELVE PLATES*)

APRIL 22, 1909
REVISED MARCH 18, 1913
REVISED JANUARY 11, 1916

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WASHINGTON
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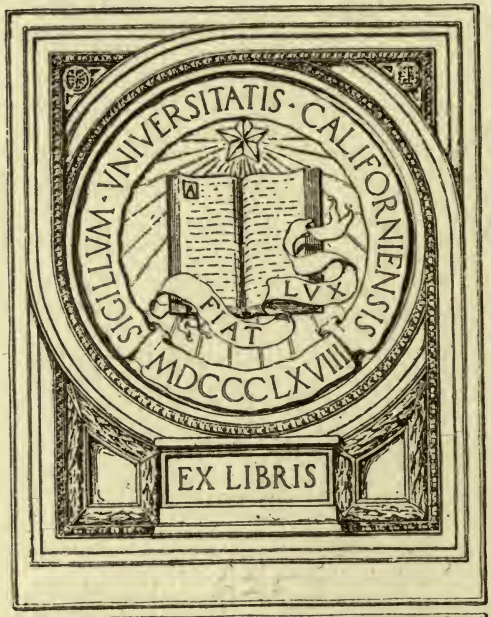
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U.S. Ordnance dept.

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War Department,
Office of the Chief of Ordnance,
Washington, January 11, 1916.

This manual is published for the information and government of the Regular Army and Organized Militia of the United States.

By order of the Secretary of War:

William Crozier,
Brigadier General, Chief of Ordnance.

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UNIV. OF CALIFORNIA

INSTRUCTIONS

FOR

MOUNTING, USING, AND CARING FOR MORTAR CARRIAGES, MODEL OF 1896 MI AND MODEL OF 1896 MII, FOR 12-INCH MORTARS, MODEL OF 1890 MI.

TWELVE PLATES.

(The points in *italics* are of importance and should be specially noted.)

GENERAL DESCRIPTION.

NOTE.—The general designs of the two mortar carriages, model of 1896 MI and 1896 MII, are very similar, the changes incorporated in the later model being mainly in the line of greater strength. The instructions below apply to both models of carriages unless otherwise indicated.

THE EMPLACEMENT (Plate I).—This emplacement is constructed of concrete, the loading platform of which is flush with the top surface of the floor plates of carriage when it is assembled. It contains a circular well 59.5 inches deep with steps on which the base ring is supported. The edge of the loading platform is not completed until the angle irons which support the azimuth circle and floor plates have been located and their curved ends embedded in the concrete. The anchor bolts are also embedded in the concrete when the emplacement is constructed.

THE CARRIAGE (Plate II).—This carriage is designed to deliver an all-round high-angle fire of from 45° to 70° elevation.

With the 1,046-pound projectile and full charge, the recoil is approximately 23 inches, measured on the piston rods.

The horizontal piece when fully counter-recoiled is 54 inches above the loading platform, and the projectile, in loading, is wheeled directly into the breech recess, the tray of the ammunition trucks forming the loading tray.

ACTION OF CARRIAGE.—Upon firing, the piece and top carriage rotate to the rear and downward about the fulcrum pins, compressing

the counter-recoil springs and forcing the crossheads and pistons downward, until the combined resistance in the recoil cylinders and the springs stop the motion, after which the compressed counter-recoil springs immediately return the piece to the loading and firing height. The movement of the crank pin through the arc of a circle causes the recoil cylinders and guides to oscillate about their trunnions.

Principal Parts.—The carriage consists of the following principal parts, viz: Base ring and floor plates, traversing roller system, racer, side frames, top carriage, recoil system, counter-recoil springs and buffer stops, elevating gear, traversing gear, azimuth circle and pointer, elevation quadrant, lanyard attachment, electrical equipment, shot trucks, shot tongs, tools and accessories, and implements.

Base Ring.—The base ring is of cast iron, in one piece, and is secured in its position by twenty-four 1.75-inch anchor bolts. The outer flange of the base ring, 14 feet in diameter, which contains the bolt holes, rests upon the upper step of the well, whose surface is 24.5 inches below the floor level of the emplacement.

The top surface is turned, forming the lower roller path and a vertical annular flange forms the male part of the pintle. The traversing rack is attached on the inside below the roller path, and its upper and lower surfaces are turned, forming the brake path.

Eight brackets, rigidly supporting the azimuth circle castings, are bolted to the outer flange, these brackets and castings, together with radial angle irons whose outer ends are embedded in the concrete, furnishing the support for the circle of cast-iron removable floor plates. There are 16 plates, retained in position by countersunk screws.

Traversing Roller System.—The racer rests and is traversed upon a circle of 24 live, conical, traversing rollers of forged steel, with a single flange. The rollers are 7.5 inches in maximum diameter, and their axes are held in the radial position by a wrought-iron (cast steel in some carriages) distance ring in six sections, in which their bronze-bushed journals have bearings. The distance ring has oil grooves finished around its top edges, reached through oil tubes in racer.

Racer and Side Frames.—The racer of the model of 1896 Mi carriage is cast in one piece, 13 feet 9.5 inches in diameter. Its lower surface is turned, forming the upper roller path, corresponding to the lower roller path on the base ring. The outside annular flange extends downward, fitting over the pintle with 0.063 inch diametral clearance. It is a cellular structure, and upon its front edge are cast two lugs or brackets to which the top carriage is pivoted by means of steel fulcrum pins. On each side of the central opening are side frames running across to the racer from front to rear. These

side frames form the supporting bearings for the recoil cylinders and also for the fulcrum pins. Three removable oil plugs permit oiling the pintle and traversing rollers.

Cast iron was originally specified as the material for the racer, and most of the carriages in service have racers of that material. As a result of the cracking of several of these racers, cast steel No. 2 is now specified, and all racers hereafter manufactured will be of this material.

(NOTE.—The cast-iron racers of carriages Nos. 104, 106, 116, 125, 148, 150, 151, 158, 165, 193, 209, 210, 237, 241, 243, 244, 260, 261, 262, 289, 294, and 300 have already been replaced by cast-steel racers.)

A few of the cast-iron racers have been strengthened by the addition of reinforcing plates of steel placed along the vertical sides of the central opening.

The racer for the model of 1896 MII carriage is cast with two longitudinal ribs, one on each side of the central opening. These ribs correspond to the side frames of the model of 1896 MI carriage, reinforcing the racer and forming bearings for the cylinder trunnions. All the racers of this model carriage are of cast steel No. 1.

TOP CARRIAGE.—The top carriage consists of two arms connected by a heavy web. The upper ends of these arms form the trunnion beds in which the mortar is mounted. The top carriage is inclined to the rear at an angle of about 41°, the lower ends being held by the fulcrum pins. Between the fulcrum and the trunnions are placed openings for the spring guide rods and the seat for the rocking counter-recoil spring cap.

All model of 1896 MI carriages, except Nos. 116, 125, 148, 149, 150, 160, 176, 204, 211, 216, 251, 254, 255, 260, 262, 283, 289, and all model of 1896 MII carriages have the "Cast steel No. 2" top carriage shown on Plate I. The excepted carriages have steel-top carriages of an older pattern.

RECOIL SYSTEM.—The recoil is checked by two hydraulic cylinders provided with trunnions which oscillate in their beds on the side frames, their lower ends extending some distance below the racer. They are of cast steel, 7.78 inches interior diameter, and are fitted with 3.5-inch forged steel piston rods working through stuffing boxes at both ends of the cylinders. About the middle of the rod is screwed and pinned a bronze piston. The stuffing boxes each contain six rings of 0.625 inch square Garlock waterproof hydraulic packing. In the walls of each cylinder are cut three grooves, each 4.6892 inches in width and of varying depth, so as to give a constant pressure in the cylinders during the entire length of recoil. The energy of

recoil is taken up by the resistance which the fluid offers to being driven through these openings.

NOTE.—The by-pass channels and openings provided in model of 1896 MI mortar carriages are not now used, all holes opening into the by-pass channels being plugged. (Plate V.) The cylinders of model of 1896 MII carriages are cast without provision for by-pass channel and openings.

The counter recoil is checked by a counter-recoil buffer. In the model of 1896 MI carriages the upper face of each piston has an annular recess, which at the end of the counter recoil passes over the annular projection on buffer on the upper bronze cylinder head. The fluid thus imprisoned is able to escape by the clearances only, its resistance gradually checks the movement, and consequently the mortar returns gently to the firing position. In the model of 1896 MII carriages the male part of the buffer is on the piston and the female part on the cylinder head, the principle being generally similar to that described above.

The filling holes are now located about the middle of the cylinders in order to obtain a void, and the oil holes on the rear side of the cylinders near the upper ends are permanently closed and can not be opened.

For all charges the cylinders should be filled to the level of the filling holes, removing for this purpose both plugs, so as to permit the air to escape.

A neutral oil, of specific gravity of about 0.85 (such as the "Hydroline" at present issued), is used, and with this oil the working pressure in the cylinders is about 5,000 pounds per square inch and the piston rod compression about 190,000 pounds. A denser oil would cause a higher pressure in the cylinders and therefore shorten the recoil slightly.

If it is desired to measure the recoil, it can be done on one of the piston rods by making several turns around it with fine twine and tying it tightly just where the piston rod enters the stuffing box. The height of the twine above the stuffing box, after firing, will indicate the counter recoil, which will also be the recoil if the mortar has returned to the firing position. If it does not return to the firing position, the counter-recoil springs should be compressed.

The lower ends of the hydraulic cylinders are connected by an equalizing pipe, in which is made up an emptying coupling, so that the resistance and the pressure in both cylinders shall be equal. The coupling is provided for emptying the cylinders at a convenient point.

The emptying coupling was originally made of bronze. These are being replaced by steel couplings as becomes necessary.

Bronze plugs are provided which can be used to replace the equalizing pipes, thus continuing the piece in action after their injury.

To the top of each cylinder are bolted two guides of cast steel, between which moves a sliding crosshead, into which the upper end of the piston rod is secured by means of a collar and nut. The crossheads are assembled over the crank pins, of forged steel, which are screwed into the trunnions of the mortar and held by spline screws.

Counter-recoil Springs and Buffer Stops.—The top carriage is supported at a point about one-third of its length from the fulcrum shaft by five columns of springs. Each column consists of five double-coil helical springs, threaded on a rod of forged steel. These five rods, arranged in a row side by side, serve to guide the springs laterally during recoil or counter recoil. They are also used to sustain the force of the springs when the mortar is dismounted temporarily—the spring compressors assisting.

For the latter purpose the spring-compressor washers are placed over the spring-compressor screws and the latter screwed into the ends of the rods (the plugs having been removed), after which the spring-compressor nuts are screwed down against the washers, until the crossheads are moved a short distance from the buffer plates.

The lower ends of these spring columns rest in a spring box of cast iron and the upper ends bear against a spring cap. The spring box is hung, by means of trunnions, in two brackets of cast iron bolted to the under surface of the racer, which permit it to oscillate during recoil to the different inclinations of the spring columns. The spring cap, performing essentially the same office above as the spring box does below, is a thin rectangular steel casting fitting over the top of the spring columns, and having upon its upper surface a well-rounded knife-edge bearing. During recoil this bearing rocks in a groove running across the lower surface of the top carriage. Both the spring cap and box are perforated to allow the ends of the spring rods to pass freely through them.

As an additional precaution against shock when returning to the firing position, buffer stops are provided. These are made up of alternate layers of balata and steel plates, and are held between the guides under the caps. The crossheads moving between the guides during counter recoil strike these buffers when the mortar returns to the firing position, and are maintained in pressure contact under the guide caps by the counter-recoil springs.

Elevating System (Plate III).—A circular rack of cast steel is bolted longitudinally to the mortar on the underside, so that the center from which its pitch line is struck is at the intersection of the axes of the trunnions and bore. This rack engages in a pinion of steel mounted on a heavy shaft on the under surface of the top car-

riage, which also carries an elevating gear to which motion is given this gear and shaft through intermediate gears by a second shaft extending across the upper face of the top carriage and bearing a handwheel at each end. The top carriage is cored out to permit the passage of the rack.

The mortar is held in the firing positions by means of a hand nut on the handwheel shaft, which locks that shaft by pressing the thrust collar against an adjoining bushing, which together form a conical friction clutch.

To protect the teeth on the elevating gearing from injury which may be caused by inertia effects during the change of elevation in recoil, the elevating shaft carries a friction device. This device consists of alternate bronze and cast-iron disks working in a recess of the elevating gear. The bronze rings rotate with the elevating gear and the cast-iron rings with the elevating shaft by means of keys, but the keying does not prevent motion in the direction of the axis of the shaft. By means of a nut, plate, and coiled spring on the elevating shaft the rings are forced together and against the elevating gear, thus forcing the latter against a shoulder of a bushing which is rigidly fastened to the elevating shaft. The elevating gear is not fastened rigidly to the shaft or to the bushing, but with the nut and spring the pressure between them can be made great enough to prevent any slipping during elevating or depressing or an undue amount of slipping during recoil. This pressure will be properly regulated if the united effort of one man applied at each of the handwheels is just sufficient to cause a slipping when an attempt is made to depress below the minimum.

More accurate adjustment should be made by regulating the friction by means of weights or a spring balance, so that slipping will occur with the mortar depressed against the stop when a force of 156 pounds is applied to the elevation handwheel shaft, at a distance of 100 inches from the center of the shaft, in accordance with General Orders, No. 63, War Department, 1914.

To hold the mortar in the horizontal position for loading and insure against accidental elevating when the breech is open, an elevation lock is provided. This consists of a lock bar and spring attached to the top carriage and engages a lock stud on the elevation rack, thus automatically locking the mortar when horizontal. To elevate the mortar, the lever which serves to withdraw the lock bolt must be operated and held open by hand until the mortar has moved sufficiently in elevation for the stud to clear the lock bar.

On each side of the elevating rack is placed an auxiliary elevation scale graduated in 10-minute intervals. Pointers attached on each side of the opening in the top carriage indicate the elevation of the mortar.

Traversing System (Plate IV).—The circular traversing rack on the inside of the base ring has meshing with it a pinion on a vertical shaft which passes down through the racer and having at its upper end a worm wheel. Motion is given the latter by means of a handwheel mounted on a worm shaft. The worm shaft, worm wheel, and the part of the vertical shaft above the racer are incased in a standard, which has oil and drain holes so arranged that the worm and the gear rim run in oil.

This standard is of cast iron for model of 1896 MI carriages, and of cast steel for model of 1896 MII carriages. The vertical traversing shaft is of cast steel for model of 1896 MI carriages and of forged steel for model of 1896 MII carriages.

In order to maintain the piece without further movement until fired after having been set in azimuth, a traversing brake is applied. It consists of a toggle and coiled spring acting to cause a brake shoe to grip the traversing rack. The brake is operated from the top side of the racer near the azimuth pointer by two pedals—a foot lever and a catch. Depressing the foot lever sufficiently to engage the catch raises the brake shoe from the brake path and permits free motion of the racer. Releasing the foot lever by depressing the catch throws the brake on.

The brake should be so adjusted that one man working on the handwheel can with difficulty just traverse the carriage when the brake is on.

Azimuth Circle and Pointer.—A brass circular strip in eight sections, about 1 inch wide and graduated to degrees, is attached to the top side of the azimuth-circle castings which surround the racer. Attached to the racer is a small brass pointer or subscale. This pointer is subdivided to 0.05° and stamped in hundredths of a degree. An electric light is attached for illuminating the scales, and a cast-iron cover when closed down protects the subscale and the light.

Elevation Quadrant.—To save time in bringing the mortar to the desired elevation and to avoid inaccuracy in placing the quadrant and holding it against its seat, a special elevation quadrant has been designed. This quadrant is similar to the gunner's quadrant, but permanently attached to the left rim base of the mortar, and consists of a bracket with a toothed arc and an arm hinged at the other end. The arm is telescoped and its front bushing carries a bubble, a micrometer, and a toothed sector which is constantly pressed outward by a spiral spring. The teeth of the sector engage in the teeth of the arc, which are cut in degrees from 45° to 75°. The micrometer, which gives a limited movement to the arm, is graduated to a least reading of one minute. When the quadrant is set to the required

angle of elevation and the piece loaded, the mortar is given the proper elevation by bringing the bubble to the center of the tube.

A canvas cover has been provided which should be kept on the quadrant when not in use.

Lanyard Attachment.—A short lanyard is attached to the underside of a stopper in the top of the racer in rear of its central opening and extends below a pulley on the pit ladder, thence upward to the safety lanyard device, and thence to the firing mechanism. The safety lanyard device consists of a bridle clip fastened to the plug set in the face of the breech, and a ring fastened at such a distance from the hook end of the short lanyard that the hook of the lanyard and ring can be fastened to the firing mechanism and the bridle clip. While loading and laying the mortar the ring should be on the clip. A pull on the lanyard is resisted wholly by the bridle clip, which will not permit the ring to slip off and allow a pull on the firing mechanism until the mortar has attained an elevation of about 43°.

The long lanyard is hooked into the eye on the top of the stopper and the stopper and short lanyard drawn to the rear to fire.

Electrical Attachments.—These consist of the firing circuit, its safety attachments, and the lighting circuits.

Firing Circuit.—The current for the firing circuit is operated by a hand-operated alternating-current magneto, type MA, located at the mortar pit. The magneto is attached to a bracket (77A) on the wall of the pit and connected with the Engineer plug box by a flexible cable 72 inches long. One end of the magneto cable is connected to the terminals (T97P and T97Q) of the magneto and the other end is connected to the cable plug (P73D) as furnished with plug box (E20B) by the Engineer Department. The magneto bracket (77A) is furnished by the Ordnance Department and is set up on foundation bolts installed by the Engineer Department. The conduits and wiring to each mortar well are furnished and installed by the Engineer Department in accordance with General Orders, No. 1, War Department, 1913. The engineer cable, type 1, terminates in a water-tight receptacle box (E25H1) bolted to the underside of the base ring. When not actually in use this box is kept closed by means of a receptacle cap (E23J) and rendered watertight by a rubber gasket.

The connection between the fixed base ring and the rotating racer etc., is accomplished by means of slicked reinforced cord, No. 16 (inclosed twisted pair, each approximately 2,583 circular mils), new code Type P. W. P. To facilitate connecting up, the inlet end of this cord terminates in a plug (E25Z) which can be quickly inserted in the receptacle referred to above, the joint being closed by means

of a plug cap (E23AC) which is screwed directly to the receptacle cover, and rendered water-tight by means of a rubber gasket. From the inlet-receptacle box on the base ring the flexible cord is led vertically downward to the bottom of the well, thence beneath two hooks which keep it always below the spring box to a double pulley centrally located on a three-legged bracket which straddles the emplacement drain. From the pulley the flexible cord is led to the left side rib of the racer opening where it terminates in a receptacle box (E25J1). This receptacle box is similar to that previously mentioned, but, instead of a screw cover, is provided with a spring cover which closes automatically whenever the safety firing plug is withdrawn, thereby preventing access of water to the interior of the receptacle.

The plug (E25Z1) is cut away on one side so that it can be inserted in the receptacle box (E25H1) in only one way. This is necessary to prevent possible short-circuiting of the magneto when firing more than one mortar.

The safety firing plug (E25AA1) is similar to that already described, except that it is not provided with a cap and gasket for making a water-tight joint when inserted in the receptacle. This is, however, unneccessary in this case, as the plug is only inserted when ready to fire, and is immediately and automatically withdrawn when the mortar is depressed after firing. From this plug another length of flexible cord, looped slack in order to let the plug chain take the strain, leads to the face of the breech, where one lead is grounded and the other fastened directly to the spring plunger of the circuit breaker. Eventually it is intended to mount a small transformer on the face of the breech, in which case both leads will be brought within the transformer casing through water-tight stuffing tubes, and connected to the primary coil of the transformer. The purpose of this transformer is to provide a break in the metallic circuit between the magneto and the primer, thereby minimizing to a great extent the possibility of premature firing due to accidental grounds or crosses between the firing and lighting circuits. For use with a single-wire primer one of the secondary leads of the transformer is grounded directly to the mortar and the other is led to an insulated contact piece which completes the circuit with the corresponding part on the breechblock when the mortar is completely rotated to its locked position.

The firing plug (E25AA1) is cut away on one side to insure its being inserted in the receptacle box (E25J1) in one way only, as explained in the case of the plug (E25Z1).

Lighting Circuit.—Current for the lighting circuit is supplied by the Engineer Department from the emplacement mains, and is led

into each well by Engineer cable, type 1, terminating in a water-tight receptacle (E25AB), as previously described for the firing circuit. The connection between the fixed base ring and rotating racer, etc., is accomplished in a manner similar to that for the firing circuit, except that the outlet end of the lighting circuit terminates in a plug (E25AD) similar to that in which the inlet end terminates. In connecting up the lighting circuits this plug is inserted into a receptacle (E25AB) which is permanently screwed into a junction box (E21T) located at the left side of the racer opening. From this junction box radiate the circuits for the azimuth lamp, elevation quadrant lamp, and portable lamp. These circuits are made up of twin-conductor, lead-covered, steel-armored cable, each conductor of 4,110 circular mils cross section, both ends secured to their respective terminal points in a water-tight manner by the use of stuffing tubes (E21Z). The circuit for the azimuth lamp passes around the inside of the racer opening until it reaches the depression for the azimuth pointer, where the cable is connected up to a water-tight receptacle box (E22N) which supports the azimuth lamp and reflector (E12P2). The circuit for the quadrant lamp leads to the upper part of the left crosshead guide where the cable is connected to a quadrant lamp bracket (E22P), which supports the quadrant lamp and reflector. The circuit for the portable lamp passes to the rear and is connected to a portable lamp plug box (E20B). Plug box and portable lamp are furnished by the Engineer Department.

Safety Features.—In order to prevent possible accidents due to the crossing of the firing and lighting circuits, the plugs (E25AD) and (E25Z) are made noninterchangeable, in that the firing plug can not be inserted by mistake in the lighting receptacle on the base ring. The insertion of the lighting plug in the firing receptacle would obviously cause no damage, but in order to prevent mistakes the words "Firing" and "Lighting" are cast in raised letters on the covers of the corresponding receptacles wherever used.

In order to prevent accidents due to firing at too low an elevation, the safety firing plug is suspended from the breech of the mortar by a chain whose length is determined by trial as only sufficient to permit contact to be made at elevations of 43° and above. Automatic closing of the firing circuit at this point is omitted advisedly.

Care of Electrical Equipment.—The electrical equipment can be divided generally into two distinct classes—the permanent, rugged, and expensive installation of armored cable and water-tight accessories on the base ring and racer; and the less rugged and correspondingly inexpensive but easily replaceable flexible cord, *which should be removed from the carriage and stored in a clean and dry place when not actually in use.* In the second class are included the complete

firing circuit and that part of the lighting circuit between the inlet on the base ring and the junction box on the racer.

Except in emergencies, *the carriage should not be traversed more than 180 degrees to the right or left of a line perpendicular to the flexible conductors on the floor of the mortar well.*

Shot Trucks and Shot Tongs.—The shot trucks for this carriage are constructed so as to admit of passing the shell directly from the truck into the mortar. Each truck consists of a light rectangular framework of steel mounted on four rubber-tired wheels and carrying a pan, in which the shell lies horizontally and at the proper height for loading. This shell pan projects to the front and is designed to enter the breech of the mortar and to supply the place of the usual loading tray. Two straight wooden bars which slip into sockets on each side of the truck serve as handles, and the two rear wheels are swiveled to facilitate turning. A brake is attached for holding the truck firmly in position against the breech while loading or unloading. Shot tongs are also provided for placing the shot on the shot truck. One pair of tongs is provided for each trolley installed by the Engineer Corps and two pairs are kept in reserve by the district ordnance officer for each battery.

Tools and Accessories and Implements.—The carriage is equipped with the tools and accessories necessary for its assembling and care. These parts, together with the implements for the mortar, except those too large, are stored in an armament chest.

ASSEMBLING THE CARRIAGE.

Implements.—The assembling requires machines and implements for mechanical maneuvers usually found at forts, such as shears, falls, blocking, jacks, sling chains, etc.

General Remarks.—The size of the carriage is such that it must be dismantled for shipment, so that when it arrives at its destination it has to be entirely assembled.

In assembling the carriage, as in all machinery, no parts should be directly struck with a steel hammer or sledge. Soft-metal drifts or copper or lead hammers should be used.

In unloading or handling the parts care should be exercised that the edge or finished surfaces do not become upset or burred. When two bearing surfaces are brought together it is especially necessary that both parts should be absolutely clean, smooth, and well lubricated.

In mounting the carriage the top, bottom, and back of the cross-head, the buffer plates, and that part of the top carriage behind the guides will be painted before assembling. These parts are not accessible after being mounted, and if not thus protected would rust badly.

In assembling guides or machined surfaces put on a thin coat of light slushing oil; slush all bolts and threads. No light slushing oil will be applied to the rollers and paths, as its use would quickly result in the accumulation of dust and dirt, this causing the parts to become gummed; simple oiling is all that is required.

The following description gives a statement of the order in which the parts should be put together rather than a complete enumeration of the details of the operation:

Base Ring.—The base ring is moved to its position over the bolts by means of skids and rollers. When the holes in the ring are directly over the corresponding bolts, lower by means of jacks, being careful to lower all at the same time. If it should be necessary to engage under the toothed rack by means of the lugs on the jacks, use three jacks about 120° apart, putting a piece of soft wood on top of each shoe. Repeat the operations of lowering until the ring is on its bed, having the bolts as nearly central in the holes as possible. On each side of every platform bolt there should be an iron wedge 6 inches long, 4 inches wide, and approximately $\frac{3}{16}$ inch thick at the larger end, resting on an iron plate 6 inches long, 4 inches wide, and $\frac{1}{4}$ inch thick. These wedges and plates serve to give the base ring proper support, enabling it to be easily leveled by driving in the wedges, and also permit the grouting to become well set without deformation while the remaining parts of the carriage are being assembled.

Leveling.—A sensitive machinist's level and an accurate steel straightedge should be used in leveling all parts.

The threads of the platform bolts and nuts should be carefully examined to see that they are not burred and are free from rust. After they are put in order thoroughly oil the threads of both bolts and nuts. In screwing down the nuts on the platform bolts take up on each bolt a little at a time, so that no part of the base ring shall be strained. The greatest care must be exercised in using the "level" and "straightedge" that the middle of the level is equidistant from the points of contact of the straightedge with the surfaces being leveled and that these points of contact on the straightedge are equidistant from either end.

In using the level it should always be reversed and the mean of the readings in the two positions considered the true reading. The preliminary leveling may be done from the top of the pintle, if machined, but for the final leveling the straightedge should be placed on the turned surface of the roller path, following around circumferentially first in one direction and then in the other, leveling and tightening the foundation bolts until no high spots are found. After the base ring is properly leveled and fixed in the place,

pour under it a grouting of neat Portland cement, being careful that the part below the level of the outside flange is thoroughly embedded. Fill the spaces between the bolts and bolt holes with melted lead.

Distance Rings and Traversing Rollers.—Clean the lower roller path and rollers very thoroughly with kerosene oil and fine emery cloth and then assemble the rollers and distance rings. After this is done run the rollers around several times by hand to see that they run freely and do not bind or stick against the distance rings.

Now bolt the eighth azimuth-circle brackets to the flange of the base ring, care being taken to see that they are in their proper places as shown by the figures stamped on them.

Racer.—Before assembling the racer the upper roller path should be cleaned in the same manner as described for the lower path, and the pintle surfaces on both racer and base ring should also be cleaned with kerosene oil and emery and then thoroughly oiled. Then place the spring box, with its brackets on it, inside the base ring, in about the position it will finally occupy, with the top surface of the feet of the brackets no higher than the floor level of the emplacement. By means of skids and rollers the racer can now be moved over its proper place, seeing that its lowest part is not less than 12 inches above the floor level of the emplacement. While in this position, raise the spring-box brackets and spring box, by means of jacks and blocking, to their proper position against the under surface of the racer and then bolt firmly to the racer by means of the studs which pass through the feet of the brackets. (If means are at hand to turn the racer bottom side up, the spring box and its brackets can be more easily and more securely assembled while in that position, after which the racer is placed in position for lowering.) Lower the racer onto the rollers; this can best be done by means of three jacks placed 120° apart, care being taken to keep blocking under it and to remove a little at a time. When in place run it around several times by hand, to see that it runs freely and the pintle surfaces do not bind. By means of rollers and pinch bars place the side frames in position over keys and dowel and bolt them to racer. The side frames being once attached to the carriage should never be removed.

Floor Plate, Ladder, and Dust Guards.—Now put the removable floor plate in place on the racer and bolt it down with the small countersunk-head screws provided for the purpose, and bolt the ladder to the inner surface of the flange on the front of the floor plate and its brace to the under surface of the floor plate in the rear. After this the dust guards, in four sections, can be bolted on the lower interior flange of the racer just inside the roller path.

Recoil Cylinders.—To prepare the cylinders for assembling, remove the guides and caps and then the crossheads, take out the top cylinder heads, remove the piston rods, and clean the cylinders thoroughly. Then coat the upper interior parts of the recoil cylinders and that part of the piston rods below the piston head, which will be above the level of the oil, with light slushing oil, to prevent the formation of rust in the space above the level of the oil in the cylinders. After oiling the parts, replace the piston rods and cylinder heads.

Removal of the piston rods will necessitate reassembling and repacking the stuffing boxes. See "Care of the carriage."

Now clean the trunnions of the cylinders and then lower the cylinders into their respective openings in the racer and side frames and bolt on the cap squares.

Top Carriage.—With the aid of rollers run the top carriage bottom side up to the front of the racer and set in the fulcrum pins and their keys and set screws. Using shears, gin, or jacks, raise the trunnion-bed end of the top carriage up past the vertical unit until it inclines well to the rear, when it should be braced preparatory to receiving the mortar. The cap squares should now be removed.

Counter-Recoil Springs.—To assemble the springs the center of the mortar trunnions should be about 5 feet 9 inches above the racer. Put five springs in the spring box and lower through them the spring rods with the locking and adjusting nuts down against the fixed nuts. Now assemble the springs and washers on the rods, four on each rod above washers, and with the aid of a tackle let fall to their approximate position against a scantling which had previously been located. The spring cap should then be placed in position.

To Mount the Mortar by Blocking the following articles are required: Oak rollers 3 feet long; one cradle 18 feet long and 3 feet wide; two 12-inch timbers 26 feet long, and two of the same length as the cribwork; a quantity of 2-inch, 6-inch, 8-inch, and 12-inch blocking, and three hydraulic jacks of 15-ton capacity. On the emplacement floor in front and rear of the racer make two parallel cribworks of blocking longer than the width of the top carriage. They should be sufficiently high to allow the two long 12-inch timbers, now laid from one crib to the other, to clear the top carriage. The outer faces of these pieces should be within the planes of the inner faces of the trunnion beds.

Build a runway in front of the carriage, so that the mortar on the cradle can be removed on the track just formed, and bring the trunnions of the piece over their beds. Carefully chock the rollers.

To Remove Cradle and Track.—Insert a heavy block in breech of mortar, allowing it to project 1 foot outside. Place head of hydraulic jack under this block close to breech and its foot on the

cradle and raise sufficiently to pass a 12-inch timber between mortar and cradle at right angles to mortar, and block up each end on crib-work outside of cradle. The crosspiece must now clear the cradle. Repeat the operation at muzzle and chock the piece front and rear. Remove cradle, rollers, and track.

To Lower the Piece.—Jack up the breech as above described, remove sufficient of the crib to allow a 4-inch drop, and lower the breech onto the cross timbers. Do same at muzzle, and continue until trunnions are in their beds. Then bolt on the cap squares.

The clearance between crosshead guides and end of trunnion is small, so great care must be taken in lowering.

Remove the braces supporting the top carriage and lower the mortar and top carriage against the springs, the top carriage rotating about the fulcrum. It will be necessary to guide, with a crowbar, the spring rods through the openings in the spring cap and top carriage. If the weight of the mortar and top carriage is insufficient to compress the springs enough to enter the piston rod nuts in the crosshead, the latter having previously been bolted to the crank pins, a tackle should be used to draw the mortar down.

To Connect the Piece with the Recoil System.—Screw the piston rod nuts with great force into the crossheads, assemble the guides to the cylinders, embracing the crossheads, and bolt on the guide caps with their balata buffers. See that the guides and crossheads are well cleaned and oiled before they are put in place. Connect the equalizing pipe with the recoil cylinders.

Elevating Gear.—Slip the elevating rack through the hole intended for it in the top carriage and bolt it securely to the mortar.

Slide elevating shaft through its bearings, friction device, and elevating pinion, screwing up on the clutch spring, adjusting nut at the same time. Bolt elevating nut pin bracket to the underside of the top carriage. Slide elevating intermediate pin through its bearings and elevating intermediate gears and fasten with tap bolt. Place in position the idler pin and elevating idler gear fastening with tap bolt. Bolt in place the elevating handwheel shaft brackets and assemble in position handwheel shaft with handwheels and collars.

Adjustment of Springs.—After the mortar is in position it may be found that the springs have not been compressed sufficiently to hold the mortar in the firing position, and that there are open spaces between the crossheads and the caps on the crosshead guides. These spaces must be closed by an additional compression of springs. For this purpose the lock nuts on the five spring guide rods are loosened and the necessary compression given by the adjusting nuts, the spindles being held from turning by means of the fixed nuts immediately over the loose springs. During the adjustment of the springs

the mortar should be occasionally jarred against the stop on the top carriage by means of the elevating handwheels. The elevation lock must be held unlocked when the mortar is jarred against the stop in order to prevent the breaking of the lock when the mortar rebounds from the stop. The proper compression is given when the springs will hold the crossheads in pressure contact under the guide caps.

Traversing Mechanism.—Thoroughly clean all the traversing mechanism preparatory to assembling, first detaching the parts which have been shipped assembled. Then put the worm and worm wheel in the pedestal brackets, engage the gears, and insert the worm shaft. Next put the vertical traversing shaft through the pedestal bracket from the lower end. Key the upper end of the shaft to the worm wheel, put on the washer and nut, and insert the split pin. Bolt the bracket for vertical traversing shaft to its pad on the underside of the racer. Support the traversing pinion in its place, engaging the rack, shrouded side up. Lower the assembled pedestal bracket, allowing the vertical shaft to enter its lower bearing and pinion. Bolt the pedestal bracket to its pad on the racer and attach the traversing handwheel. If necessary, turn the handwheel to adjust the keyway for the traversing pinion and secure the pinion with key, washer, and nut. Put on the cover. Attach traversing brake.

Azimuth Circle.—The azimuth-circle castings should next be put in place, fitting the ends together as marked, care being taken to see that the inner edge of the circle is central with the racer and 83.5 inches radius, so that the clearance between it and the racer is the same all around. Then bolt on the angle-iron brackets to support the floor plates and level them up with the plates on them, the outer ends being blocked up. The outer point at which these angle brackets are supported temporarily must not be more than 22 inches from the racer or else the supports will interfere with the filling in of the emplacement with concrete, which is to form the sides of the mortar pit and hold the brackets rigid.

Important Points.—After the carriage has been completely assembled and the mortar mounted, the following points should be noted, viz:

1. Traverse the carriage each way and elevate and depress the mortar, to see that they work freely.

2. Examine and clean out all oil holes, noting that they have oil plugs.

3. See that there is not a hard bearing between the rim bases of the mortar and the top carriage, between the crossheads and crankpin shoulders, and between the cylinder rim bases and their bearings, as these conditions would indicate parts out of alignment.

4. See that the elevating rack is firmly attached, that the counter-recoil springs maintain the mortar fully "in battery," and that

the elevation stop permits the piece to be depressed to horizontal position so that projectiles can be rammed without interference..

5. See that the dust guard does not bind or rub on the traversing rack and that the inner edge of the azimuth-circle castings are concentric with the revolving racer.

6. Attach the elevation quadrant, using a clinometer supported by a rest in the muzzle of the piece while fitting it, to test its adjustment. With the piece set horizontal the leveling of the base ring can be tested by traversing to each 90° position and noting the reading of the clinometer.

7. Orient the mortar, add numbers to the degree marks on the azimuth circle, and adjust azimuth pointer to indicate correct azimuth. Muzzle at true south is 0° in azimuth and numbers are placed around clockwise to include 359.

8. See that electrical connections have been properly made by trying the lights and the firing circuits.

To Dismount Carriage for Purpose of Cleaning Trunnions and Springs.—Remove crosshead guides and guide caps and unscrew piston-rod nuts. Then with the aid of jacks, skids, and blocking raise the mortar, the carriage rotating about the fulcrum until the center of the trunnions is about 5 feet 9 inches above the racer. The spring cap, spring washers, and rods can then be removed. With the springs out the trunnion cap squares can be removed and the top carriage lowered sufficiently to clean the trunnions and their beds. The same operation in the reverse order should be followed when assembling.

CARE OF THE CARRIAGE—GENERAL INSTRUCTIONS.

Carriages should be traversed from time to time through their entire movement, and left at a different azimuth each time.

It is especially required that all parts of the carriages must be kept free from rust *at all times*. If this be allowed to accumulate its removal from all bearing parts, and especially piston rods, requires particular attention in order that clearances shall not be unduly increased. The use of sandpaper for this purpose is forbidden, and emery cloth No. 1, being coarse enough for any ordinary rusting, should be used, the rust being softened, if necessary, by coal oil.

If any leakage occurs from the hydraulic recoil system, it should be immediately remedied, calling, if necessary, upon the district armament officer for the services of skilled labor.

The repacking of stuffing boxes may be done when necessary by trained enlisted men under the supervision of an officer, but will preferably be done by skilled labor.

Before removing a cylinder head containing a stuffing box, or drawing a piston rod through a stuffing box, the pressure of the packing on the rod should be released by unscrewing the follower several turns.

The vulcanized fiber or copper gaskets between cylinders and their heads should be in good condition and consequently should be replaced whenever necessary in order to prevent leakage.

Recoil cylinders should be emptied at least every three months and thoroughly cleaned every six months.

Cleaning Recoil Cylinders.—For this cleaning a plumber's hand force pump will be supplied to each Coast Artillery post, with about 10 feet of suction hose and 15 feet of discharge tube.

It will be noted that in no case will it be necessary to remove the packing from the stuffing box to clean the cylinders.

In cleaning, the following order of operations may be followed:

(*a*) Remove oil from cylinders and equalizing pipes.

(*b*) Compress the counter-recoil springs by means of the assembling screws, so as to lower the mortar a few inches, remove the guides and caps and disconnect and remove the crossheads.

(*c*) Unscrew the cylinder heads and carefully withdraw the piston rods out of the cylinders. Each part dismounted should be marked to insure its being assembled in its correct place.

(*d*) Thoroughly clean the cylinders with coal oil forced from a hand pump into both ends of each cylinder. The plug in the emptying coupling should be removed and both branches of the equalizing pipe flushed out from their cylinder ends. Then wipe the interior of the cylinders dry with clean cotton waste and clean the piston rods and cylinder heads.

(*e*) Replace the emptying coupling plug, assemble the piston rods, cylinder heads, crossheads, caps, and guides, exercising great care that none of the parts are burred or otherwise damaged. The cylinder heads should be firmly screwed into place, care being taken that the packing ring is in good condition and properly placed. Screw the followers tight against the packing in the stuffing boxes.

(*f*) All parts dismounted should be carefully inspected to ascertain that they have been properly assembled.

Removing Packing from Stuffing Boxes (using new extractor furnished by the Ordnance Department).—Close the extractor around the piston rod and insert the locking pin. Turn the extractor to the left, with pressure on the packing, until the needles are firmly engaged in the packing. Draw the packing out, turning slowly to the left. In the case of a box with interior thread and if the ring is tight it should be unscrewed and not stripped out by the thread, because unless unscrewed it would catch upon and be injured by the thread.

Extractor bars are provided to be used for starting the packing from its seat and by inserting the toes of the bars in the rack teeth and prying over the edge of the box, being careful not to injure the thread.

To Pack a Stuffing Box.—To pack a stuffing box, after drawing the oil from the cylinders, remove the follower and with it the rings and all the packing in the box. Examine the old packing and discard all unfit for use. If any of the old packing is used, it should be put in after the new.

In packing a stuffing box put on the piston rod one ring of 0.625-inch Garlock's "waterproof hydraulic" packing, and force it well to the bottom of the stuffing box by a wooden stick and mallet. Treat each layer of packing in a similar manner, until the required amount, with the old on top when any of the latter is used, is inserted.

Put the halves of the ring on the follower, enter them together in the box, and screw up the follower, being careful to note that the halves of the ring do not bind on the screw threads.

No more force should be used on the spanner wrench than that of two men, and generally that of one man is sufficient. The addition of a pipe to the end of the spanner wrench should not be permitted.

When the box is properly filled and the follower tightened there should be for the lower boxes not more than 1 inch of space between the flange of the follower and the piece into which the follower is screwed. For the upper boxes there should be not less than 24 inches between the followers and the piston-rod nuts.

The follower should be tightened from time to time. If the follower is screwed into the stuffing box too tightly, an unnecessary amount of friction will be produced on the piston rod. When the follower is screwed in until the flange strikes the box another ring of packing should be inserted.

It is to be expected that a slight amount of oil will soak through and drip from boxes or carriages when not in use. Also, when tightening the followers, a slight amount of oil will squeeze out of the saturated packing. This oil should be caught and not allowed to render the carriage unsightly.

Filling Recoil Cylinders.—To fill the cylinders with oil, remove the two plugs, one in each cylinder. Pour clean neutral oil of specific gravity about 0.85 (such as the "hydroline" now issued to the service) into the hole of one cylinder until it flows out of the hole of the other. Allow any air that may be present to escape, then pour in more oil until the same is level with the filling holes. About 9.5 gallons are required.

Service Condition (Lubrication, etc.).—When the carriage is to be kept in readiness for service and is in daily or frequent use all bearing parts must be kept clean and lubricated. Special attention

should be given to the lubrication of trunnion bearings, crossheads and guides, rollers, pintle surfaces, elevating rack and gears, and traversing mechanism, including the teeth of all gears.

The above parts should be lubricated at frequent intervals whether the carriage is maneuvered or not. When carriages are in use for daily drills a thorough lubrication twice each week should be sufficient for all but the most severely used parts.

Proper lubricating and cleaning of the traversing rollers and their paths are essential to the free working of the carriage.

When oiling the rollers or the pintle the carriage must be traversed in order to distribute the oil throughout the whole circumference.

It will occasionally be necessary to examine the rollers, to see that the dust guards are in proper place and that the rollers themselves are clean. If they are found dirty they must be cleaned with kerosene oil, but care must be taken to fill the bearings with synovial oil after the kerosene has been rubbed dry. Experience has shown that recoil cylinders should not remain empty, as in that case the interior walls soon become rusty.

Oil Holes.—Oil holes, where provided, must be cleaned out frequently to keep them free from sand and grit and will habitually be kept closed by the screw plugs provided, except when in the act of oiling.

Before oiling at any hole, wipe off carefully any dirt or grit near the opening that might be carried down into the bearing by the oil.

Compression Grease Cups.—Where compression grease cups are provided similar precautions against dirt or grit must be observed. In filling these cups do not fill the cup completely, but fill only to the bottom of the bevel at the top of the cup; if too full, the leather packing will become inverted and will not act effectively. In putting on the cap see that the leather-packed follower enters the cup without being caught, cut, or bent by the edge of the cup, or otherwise. Screw the cap down on the cup, using a wrench, if necessary, to secure sufficient power, until the spring rod projects about 0.25 inch above the top of the cap. Later, when the spring has recovered and has moved the follower forward, forcing the grease through the tube into the bearings, which will be indicated by the spring rod being pulled into the cap until its nut touches or nearly touches the cap, it will again be necessary to screw up the cap on the cup until the spring is again compressed. When the cap is screwed nearly home and the spring rod does not project it is an indication that the cup should be refilled.

For further information regarding paints, oils, cleaning material, and methods of using same see Ordnance Department pamphlet Form No. 1869. Annual allowances will also be found therein.

See also Circular No. 29, War Department, 1910.

Names of parts of 12-inch mortar carriages, model of 1896 Mi and model of 1896 Mii, their piece marks, location, and material of which they are made.

The parts are listed alphabetically under the following headings: Carriage proper; the electrical equipment, including the firing circuits, ammunition truck; shot tongs; lanyard attachment; elevation quadrant; and grease cup.

When referring to a part, always mention its piece mark, where given on the list.

Br.....Brass.
Bz.....Bronze.
C.....Copper.
C. I.....Cast iron.
C. R. S.....Cold rolled steel.
Cond.....Condensite or equal.
C. S.....Cast steel.
F. V. F.....Flexible vulcanized fiber.
G. I.....Galvanized iron.
G. S.....German silver.
G. W. H. P.....Garlock waterproof hydraulic packing.
H. R.....Hard rubber.
L.....Lead.
M. I.....Malleable iron.
P. Bz.....Phosphor bronze.
S.....Steel.
S. B.....Sheet brass.
S. C.....Sheet copper.
S. R.....Sheet rubber.
S. S.....Sheet steel.
Sp. S.....Spring steel.
V. A.....Vulcanized asbestos.
V. F.....Vulcanized fiber.
W. I.....Wrought iron.

12-INCH MORTAR CARRIAGE, MODEL OF 1896 Mi.

Piece mark.	No.	Name of part.	Location.	Material.	Remarks.
	1	Adjusting plug	In upper brake lever	S	
	1	Adjusting screw	In adjusting plug	S	
	8	Angle irons	Under floor plate	S	
	8	....do	....do	S	
	1	Armament chest	With 4 carriages	Oak	Complete.
	1	Azimuth circle	On azimuth circle bracket	C. I	In 8 sections.
	8	Azimuth circle bracket	On base ring	C. S	
	1	Azimuth pointer	On racer	S. B	
	1	Base ring	On platform	C. I. No. 2	
U45M	1	Bar screw driver	In armament chest	S	
U45N	1	....do	....do	S	
U45AA	1	....do	....do	S	
	15	Bolt, countersunk, with nuts.	Floor plate to angle	Bz	0.75 by 3.5.
	3	....do	For pit ladder	S	0.75 by 2.
	1	....do	For pit ladder brace	S	0.75 by 1.75.
N18B	1	....do	For quadrant bracket	Bz	0.5 by 2.
	1	Bolt (special)	Floor plate to angle	Bz	0.75 by 3.
	12	Bolt tap	For traversing rack	S	0.75 by 3.
	16	....do	Azimuth circle bracket to base ring.	S	1.25 by 3.
	16	....do	Azimuth circle to bracket	S	0.75 by 2.25.
	36	....do	For dust guard	S	0.5 by 1.
	8	Bolt, tap (special)	For cap squares	S	2 by 4.25.
	28	Bolt, tap	Side frames to racer	S	1.5 by 4.5.
	4	....do	For equalizing pipe bracket	S	0.75 by 1.5.
	2	....do	For elevating shaft bushing	S	0.75 by 1.5.
	2	....do	For lower brake lever stop	S	1 by 1.75.
	4	....do	For elevating rack	S	1.375 by 2.625.
	4	....do	Handwheel shaft bracket, right.	S	0.75 by 2.25.
	4	....do	Handwheel shaft bracket, left.	S	0.75 by 2.25.
	1	....do	For elevating intermediate pin bracket.	S	0.75 by 1.5.
	1	....do	For idler pin	S	0.75 by 1.5.
11E	5	....do	For elevating-lock bracket	S	0.875 by 2.25.
11J	2	....do	For elevating-lock strap	S	0.625 by 1.125.
13EA	2	Bolt, tap (special)	For drip pan	S	0.5 diameter.
	2	Bolt, tap	For spring-box bracket	S	2 by 11.5.
	8	....do	Pedestal to racer	S	1 by 3.
	8	....do	Cover to pedestal	S	0.375 by 1.25.
	4	....do	For foot-lever bracket	S	0.625 by 2.25.
	4	....do	Bracket to racer	S	1.25 by 3.75.
N20G	2	....do	For left-hand scale	S	0.375 by 1.75.
	8	Bolt, with nuts	Azimuth circle sections	S	1.25 by 4.5.
	8	....do	....do	S	1.25 by 4.75.
	8	....do	....do	S	1 by 2.75.
	36	....do	For distance ring	S	1 by 3.6.
11C	1	....do	For elevation lock	S	
	2	....do	For equalizing pipe bracket	S	0.75 by 2.
	1	....do	For clutch-spring adjusting nut.	S	0.625 by 5.
	4	....do	For elevating intermediate pin bracket.	S	1 by 5.25.
	4	....do	....do	S	1 by 4.5.
	8	....do	Cylinders to guides	S	1.5 by 5.
	8	....do	Caps (13 F) to guides	S	1.25 by 6.25.
	1	Box	For springs	C. I. No. 2	

Names of parts of 12-inch mortar carriages, model of 1896 MI and model of 1896 MII, their piece marks, location, and material of which they are made—Continued.

12-INCH MORTAR CARRIAGE, MODEL OF 1896 MI—Continued.

Piece mark.	No.	Name of part.	Location.	Material.	Remarks.
U44AB	1	Box wrench	In armament chest	F. S.	
	1	Bracket	On top carriage	C. S. No. 2	For elevation lock.
	1	do	Under racer	C. I	For vertical shaft.
	1	do	For traversing brake	C. S	
N18D	1	do	For elevation quadrant	Bz	
N18E	1	Bracket base	do	C. S	
11D	2	Brake lever pins	In bracket	S	
	1	Brake link	Through racer	S	
	1	Brake link spring	On brake link	S	
	1	Brake link lower pin	In brake link	S	
	1	Brake link upper pin	do	S	
	2	Brake shoes	On brake levers	C. S. No. 1	
	48	Bushings	On traversing rollers	Bz	
	4	Bushing (in halves)	In side frames	Bz	2 right, 2 left.
	1	Bushings	In top carriage	Bz	For elevating handwheel shaft.
	1	do	do	Bz	Do.
	3	do	do	Bz	For elevating shaft
	1	Bushings (long)	In elevating intermediate gears.	Bz	
	1	Bushings (short)	do	Bz	
	1	Bushings	In elevating handwheel shaft bracket (right).	Bz	
	1	do	In elevating handwheel shaft bracket (left).	Bz	
13K	2	do	In crossheads (13G1) (13H1)	Special Bz	
	5	do	In washers, or spring guide rod.	Bz	
	2	do	In spring box brackets	Bz	
	1	do	In pedestal bracket	Bz	For vertical shaft.
	2	do	do	Bz	For handwheel shaft.
13F	....	Caps	On guides (13A) (13B) (13C) (13D).	C. S. No. 1	
	1	do	For counter-recoil springs	C. S	
	4	Cap squares	On side frames	C. S. No. 2	2 right, 2 left.
	2	do	On top carriage	C. S. No. 2	1 right, 1 left.
	1	Catch	In foot lever bracket	C. S	
	1	Catch pin	do	S	
	1	Catch spring	do	S	
	1	Catch spring plunger	do	Bz	
	1	Clutch spring	On elevating shaft	Sp. S	
	1	Clutch spring adjusting nut.	do	F. S	
	1	Clutch spring plate	do	C. S	
13S	4	Collar	For pipe connection	S	
13CA	2	do	On piston rod	F. S	
	1	do	On traversing handwheel shaft.	S	
11P	1	do	On lock bar	S	
	1	Collar nut	On elevating handwheel shaft.	F. S	For MI carriage.
	2	do	do	F. S	For MII carriage.
5A	1	Core hole cover	On racer	C. I	
	25	Counter recoil springs (outer).	On spring rod	Sp. S	
	25	Counter recoil springs (inner).	do	Sp. S	
	4	Covers	On side frames	S	
	1	Cover	On pedestal bracket	C. S	
6A	1	do	For elevation quadrant	Cotton duck	No. 9, olive drab.
13G1	1	Crosshead	Between guides	F. S. No. 2	
13H1	1	do	do	F. S. No. 2	
13Y2	1	Cylinder (right)	In side frames	C. S. No. 2	
13Z2	1	Cylinder (left)	do	C. S. No. 2	
13X1	2	Cylinder heads	In cylinder (13Y2) (13Z2)	Bz. No. 4	
13V	10	Cylinder plugs (small)	do	F. S. No. 3	
13W	2	Cylinder plugs (large)	do	F. S. No. 3	
	1	Direction plate (clamp)	On hand nut	Bz	
	2	Direction plate (elevate)	On elevating handwheel	Bz	1 right, 1 left.
	2	Direction plate (depress)	do	Bz	Do.
	1	Distance ring	Between racer and base ring	C. S	In 6 sections.
U43L	1	Double wrench	With carriage	F. S	2 and 2.5.
U43J	1	do	In armament chest	F. S	1.5 and 1.75.
U43AK	1	do	do	F. S	1.25 and 1.375.
U43AN	1	do	do	F. S	1 and 1.125.
U43F	1	do	do	F. S	0.625 and 0.75.
U43C	1	do	do	F. S	0.375 and 0.5.

Names of parts of 12-inch mortar carriages, model of 1896 MI and model of 1896 MII, their piece marks, location, and material of which they are made—Continued.

12-INCH MORTAR CARRIAGE, MODEL OF 1896 MI—Continued.

Piece mark.	No.	Name of part.	Location.	Material.	Remarks.
	4	Dowels	For side frames	S.	
	2	do	For azimuth pointer	S.	
	2	do	For right-hand scale (N20B)	Br.	
	2	do	For left-hand scale (N20M).	Br.	
	2	Drain plugs	In pedestal bracket	S.	
	1	do	In emptying coupling	W. I.	
	2	Drip pans	For stuffing boxes	S.	
	1	Dust guard (complete)	Inside racer	S.	In 4 sections.
	1	Elevating gear	On elevating shaft	Bz. No. 4	
	1	Elevating-gear bushing	do	F. S.	
	1	Elevating handwheel shaft bracket.	On top carriage	C. I.	Right. For MI carriage.
	1	do	do	C. I.	Left. For MI carriage.
	1	Elevating handwheel shaft pinion.	On elevating handwheel shaft.	F. S. No. 2	
	1	Elevating handwheel (right).	On handwheel shaft	S.	Complete, including handle.
	1	Elevating handwheel (left).	do	S.	Do.
	1	Elevating handwheel shaft.	In top carriage	F. S. No. 2	For MI carriage only.
	1	do	do	F. S. No. 2	For MII carriage only.
	1	Elevating idler gear	On idler pin	Bz. No. 4	
	1	Elevating intermediate gear.	On elevation intermediate pin.	F. S. No. 2	Pinion and gear together.
	1	Elevating intermediate bracket.	On top carriage	C. I.	
	1	do	do	C. I.	For MI carriages.
	1	Elevating intermediate pin.	In top carriage	F. S. No. 3	
	1	Elevating pinion	On elevating shaft	F. S. No. 2	
	1	Elevating rack	On mortar	C. S.	
	1	Elevating shaft	In top carriage	F. S. No. 3	
N20E	1	Elevation pointer (right)	On top carriage	Bz.	
N20A	1	Elevation pointer (left)	do	Bz.	
	1	Elevation stop	do	Bz. No. 3	
	1	Emptying coupling	On equalizing pipe	F. S. No. 2	
	1	Equalizing pipe	Under cylinders	S.	In 2 parts.
	2	Equalizing pipe bracket	do	W. I.	
5C	....	Filler piece	On racer	S.	Used where needed.
11B	1	do	For elevation lock	S.	
5J	....	do	do	S.	Do.
N20H	1	do	Between scale (N20M) and elevating rack.	Bz.	
U46F1	1	Filling funnel	In armament chest	C.	
N20J	2	Filler pieces	Between scale (N20M) and elevating rack.	Bz.	
	1	Floor instruction plate	On floor plate	Bz.	
	16	Floor plates	On azimuth circle and angles.	C. I.	
	1	File card	In armament chest	Commercial.	
13N1	4	Followers	In cylinder heads (13X1)	Bz.	
13T1	4	do	For pipe connection	Bz. No. 4	
	1	Foot lever bracket	In foot lever bracket	C. S.	
	1	do	On racer	C. S.	
	1	Foot lever pin	In foot lever bracket	S.	
	5	Friction disk (inner)	On elevating shaft	C. I.	
	5	Friction disks (outer)	do	Bz. No. 4	
	1	Friction filler piece	On elevation handwheel shaft.	C. I.	For MI carriage only.
	2	Fulcrum bolts	In lever on elevation rack	S.	With 2 crown nuts.
	2	Fulcrum bushings	In top carriage	Bz. No. 3	For model of 1896 MII only.
	2	do	do	Bz. No. 3	For model of 1896 MI only.
	2	Fulcrum pins	In side frames	F. S.	
	2	do	do	F. S. No. 2	For model of 1896 MII only.
	2	Fulcrum pin washer	On fulcrum pins	F. S. No. 2	Do.
	2	Fulcrum washers	On top carriage	Bz. No. 3	Do.
	4	Gaskets	For plugs (13P)	F. V. F.	
	2	do	For plugs (13U2)	C.	
	12	do	For plugs in cylinders (13Y2) (13Z2).	C.	2 large, 10 small.
	2	do	Under cylinder heads (13X1).	F. V. F.	

Names of parts of 12-inch mortar carriages, model of 1896 MI and model of 1896 MII, their piece marks, location, and material of which they are made—Continued.

12-INCH MORTAR CARRIAGE, MODEL OF 1896, MI—Continued.

Piece mark.	No.	Name of part.	Location.	Material.	Remarks.
U55FA	1	Gland wrench	In armament chest	S.	
	1	Graduation strip	On azimuth circle	Br.	In 8 sections.
13A	1	Guide, front (right)	On cylinders (13Y2)	C. S. No. 1.	
13B	1	Guide, front (left)	On cylinders (13Z2)	C. S. No. 1.	
13C	1	Guide, rear (right)	On cylinders (13Y2)	C. S. No. 1.	
13D	1	Guide, rear (left)	On cylinders (13Z2)	C. S. No. 1.	
	1	Hand nut	On elevating handwheel shaft.	S.	
	1	Hinge	For azimuth pointer cover.	Bz.	
	1	Idler pin	In top carriage	F. S. No. 2.	
	6	Keys	In distance ring	S.	
	2	do	In fulcrum pin	S.	For side frames.
	4	do	Under side frames	S.	
	3	do	In elevating gear	S.	Riveted in.
	2	do	In elevating intermediate gears.	S.	
	4	do	In elevating shaft	S.	
	3	do	In elevating handwheel shaft.	S.	
	1	do	In traversing handwheel shaft.	S.	
	2	do	In vertical traversing shaft.	S.	
N20M1	1	Left-hand scale	On elevating rack	Monel metal.	
11N	1	Lever	On bracket on top carriage	F. S.	
11M	1	Lever pin	For elevation lock	S.	
11R	1	Lever rest	do	F. S.	
	1	Lid	For azimuth pointer	Bz.	
U47S	4	Lifting hooks	In armament chest	S.	
13Q1	1	Liner (right)	On crossheads (13Q1)	Bz.	
13R1	1	Liner (left)	On crossheads (13H1)	Bz.	
13J1	2	Liner	On crosshead (13G1) (13H1)	Bz.	
	5	do	On spring guide rods	Br.	
11L	1	Link	For elevation lock	S.	
11F	1	Lock bar	In bracket on top carriage	F. S. No. 3.	
11G	1	Lock stud	In elevating rack	F. S. No. 3.	
	1	Lower brake lever	In bracket	C. S.	
	1	Lower brake-lever stop	For traversing brake	S.	
	1	Lower toggle lever	On lower brake lever	C. S.	
	1	Name plate	On traversing handwheel	Bz.	
	1	Name plate (No. 2)	On top carriage	Bz.	
13L	2	Neck rings	In cylinders (13Y2) (13Z2)	Bz.	
13BA1	2	Nuts	In crossheads (13G1) (13H1)	F. S. No. 2.	
	5	do	For spring guide rods	S.	2.75 thick.
	5	do	do	S.	1.5 thick.
	2	do	On vertical traversing shaft	S.	
	2	do	For toggle pin	S.	
	1	do	On upper toggle link	C. S.	
U46A	2	Oilers (half-pint)	In armament chest	S.	Commercial.
U46B	1	Oilers (locomotive, 1 quart).	do	S.	Do.
	1	Oil pipe	In racer	Br.	For inside of distance ring.
5F	1	do	do	Br.	For outside of distance ring.
5G	1	do	do	Br.	For pintle.
	1	do	In pedestal bracket	Br.	
5K	2	Oil-pipe brackets	On racer	Bz.	
	1	Oil-pipe bushing	In racer	Bz.	
5D	2	Oil-pipe strap	On racer	S.	
Q3C	26	Oil plugs, 0.375 standard	In carriage	Bz.	
Q3K	12	Oil plugs, 0.625 standard	do	Bz.	
13M	4	Packing rings	On followers (13N1)	Bz.	In halves.
	1	Pedestal bracket	On racer	C. S.	
13JA	14	Pieces	Under caps (13F)	Balata	Part of buffer.
	8	Pins	For bushings on top carriage.	Bz.	0.25 diamond driven.
	2	do	In elevating intermediate gears.	S.	Driven.
	4	do	do	Bz.	0.25 by 0.625 driven.
	4	do	do	Bz.	0.25 by 0.75 driven.
	3	do	In elevating handwheel shaft bracket (right).	Bz.	0.25 by 0.875 driven.
	4	do	In elevating handwheel shaft bracket (left).	Bz.	0.25 by 1.25 driven.
	2	do	For brake shoes	S.	
	4	do	In brake levers	S.	
	1	Pinion	On vertical traversing shaft.	Bz.	

Names of parts of 12-inch mortar carriages, model of 1896 MI and model of 1896 MII, their piece marks, location, and material of which they are made—Continued.

12-INCH MORTAR CARRIAGE, MODEL OF 1896 MI—Continued.

Piece mark.	No.	Name of part.	Location.	Material.	Remarks.
13DA	2	Piston	On piston rod (13AA)	Bz. No. 4	
13AA	2	Piston rod	In cylinders (13Y2) (13Z2)	F. S. No. 3	
U43AM1	1	Piston-rod wrench	With carriage	F. S.	
	1	Pit ladder (complete)	Under removable floor plate	W. I.	
11K	1	Pivot stud	For elevation lock	S.	
13GA	2	Plates	Under caps (13F)	S.	Part of buffer.
13HA	12	do	do	S.	Do.
13U2	2	Plugs	In cylinders (13Y2) (13Z2)	Bz. No. 3	
13P	4	do	do	Bz.	
13E	3	Plugs (1 extra)	In cylinder	Bz.	To replace equalizing pipe.
	4	Quadrants, gunners'	In armament chest		
5H	1	Racer	On base ring	C. S. No. 2	
	1	Reinforce plate	Under floor plate	S.	
	1	Removable floor plate	On racer	C. I.	
N20B	1	Right-hand scale	On elevating rack	Monel metal.	
	24	Rings, packing	In cylinder boxes	G. W. H. P.	
	2	Rivets	For reinforce plate	S.	0.375 diamond.
	3	do	In elevating gear	S.	For keys.
U44GA	1	Rod (for spanner wrench)	In armament chest	S.	
	24	Screws	For bushings in side frames	Bz.	0.5 by 1.125.
	32	do	For trunnion cap bushings	Bz.	0.5 by 1.125.
	2	do	For azimuth pointer	Br.	
	2	Screws, countersunk	For floor instruction plate	Bz.	0.25 by 0.68.
	72	do	For graduation strip	Bz.	0.25 by 0.75.
	144	do	For traversing roller bushings.	Bz.	0.25 by 0.75.
5B	4	do	For core-hole cover (5A)	Bz.	0.5 by 1.5.
	11	do	For removable floor plate	S.	0.5 by 1.25.
	2	do	For elevation stop	S.	0.5 by 1.375.
13FA	32	do	For liners (13J1) (13Q1) (13R1).	Br.	
	30	do	For liners on spring guide rods.	Bz.	
N18C	2	do	For bracket (N18D)	Bz.	
N20L	1	do	For filler piece (N20H)	S.	
	3	do	For hinge on azimuth pointer.	S.	
	2	Screws, fillister head	For elevating rack	S.	1.375 by 2.625.
N18A	2	do	For bracket base	S.	
	2	Screws, headless	In elevating intermediate gears.	S.	0.25 by 0.625.
5E	2	Screws, round head	For oil-pipe strap (5D)	Bz.	0.375 by 0.75.
5E	2	do	For oil-pipe bracket (5K)	Bz.	0.375 by 0.75.
	16	do	Cover to bushing	Bz.	0.25 by 0.375.
	2	do	For direction plate (clamp)	Br.	0.125 by 0.3.
	12	do	For direction plate (elevate) (depress).	Br.	0.25 by 0.5.
N20D	4	do	For elevation pointer (N20E) (N20A).	Br.	
	1	Screw (special)	For catch pin	Bz.	
N20F	2	do	For right-hand scale (N20B)	Bz.	
	15	Separators	On spring-guide rods	S.	
	2	Set screws	For fulcrum pin	S.	1.5 by 3.625.
	4	Shaft bracket washer	Under shaft bracket	S.	For MI carriage only.
	2	Side frames	On racer	C. S. No. 2	1 right, 1 left.
U44T	1	Spanner wrench	In armament chest	F. S.	3.
U44W	1	do	do	F. S.	4.625.
U44HA	1	do	do	C. S.	For lower followers.
N18F	2	Spline screws	For screw (M18A)	S.	
	15	Split pins	In countersunk bolts	S.	For floor plate.
	1	do	On lock bar (11F)	S.	
	1	do	For link bolt of elevation	S.	
	2	do	For stop pin	S.	
	2	do	For fulcrum pin	S.	
	1	do	In taper pin	S.	For elevating pinion.
	1	do	do	S.	For elevating hand wheel shaft pinion.
	1	do	do	S.	For thrust collar.
	1	do	do	S.	For collar nut.
	1	do	do	S.	For collar on lock bar.

Names of parts of 12-inch mortar carriages, model of 1896 MI and model of 1896 MII, their piece marks, location, and material of which they are made—Continued.

12-INCH MORTAR CARRIAGE, MODEL OF 1896 MI—Continued.

Piece mark.	No.	Name of part.	Location.	Material.	Remarks.
	2	Split pins	For fulcrum bolt	S	
	2	.....do	For vertical traversing shaft	S	
	1	.....do	For taper pin, on traversing handwheel shaft.	S	
	1	.....do	For upper toggle link	S	
	2	.....do	For upper toggle pin	S	
	2	.....do	For brake-link upper pin	S	
	2	.....do	For brake-link lower pin	S	
	2	.....do	For foot-lever pin	S	
	4	.....do	For brake-shoe pins	S	
	2	.....do	For upper brake-lever stop	S	
	4	.....do	For brake-lever pins	S	
11A	1	Spring	For elevation lock	Sp. S	
U47BL	2	Spring-box brackets	Under racer	C. I. No. 2	1 right, 1 left.
U47BM	5	Spring compressor (screws).	In armament chest	S	
U47BN	5	Spring compressor (nuts).	.....do	S	
	5	Spring compressor (washers).	.....do	C. I	
	5	Spring guide rods	In counter-recoil springs	F. S. No. 2	
	5	Spring guide-rod plugs	In end of spring-guide rods	Bz	
U43AL	2	Spring-rod wrench	With carriage	F. S	
	1	Spring washer	On brake link	S	
	1	Stop pin	For traversing brake	S	
11H	1	Strap	On top carriage	F. S	
	4	Studs, with nuts	In top carriage	F. S. No. 3	2.5 by 9.75.
	14	.....do	For spring box bracket	S	2 by 8.625.
	1	Taper pin	In elevating pinion	S	
	1	.....do	In elevating handwheel shaft pinion.	S	
	1	.....do	In thrust collar	S	
	1	.....do	In collar nut	S	
	1	.....do	In collar on lock bar	S	
	5	.....do	In washer, or spring guide rod.	S	
	1	.....do	In traversing handwheel	S	
	1	.....do	In collar on traversing handwheel shaft.	S	
	1	Thrust collar	On elevating handwheel shaft pinion.	F. S	For MI carriage only.
	2	Toggle lever pins	In toggle levers	S	
	1	Toggle pin	Between toggle levers	S	
	1	Top carriage	On fulcrum pins	C. S. No. 2	
	1	Traversing handwheel shaft.	In pedestal bracket	F. S	
	1	Traversing handwheel	On traversing handwheel shaft.	C. S. No. 3	Complete, with handle.
	1	Traversing rack	On base ring	C. I. No. 1	
	24	Traversing rollers	In distance ring	F. S. No. 3	
	1	Traversing worm	In pedestal bracket	F. S	
	2	Trunnion cap bushing	In top carriage	Bz. No. 3	In halves, 1 right, 1 left.
	1	Upper brake lever	In bracket	C. S	
	1	Upper brake-lever stop	.....do	S	
	1	Upper toggle lever	Under upper brake lever	C. S	
	1	Upper toggle link	In upper brake lever	C. S	
	4	Vertical shaft bracket studs.	In racer	S	With nuts.
	1	Vertical traversing shaft.	In pedestal bracket	F. S	
	1	Washer	On elevating handwheel shaft.	S	For MI carriage.
	1	.....do	.....do	Bz	For MII carriage.
	4	.....do	For pipe connection	F. V. F	
	12	.....do	For plugs in cylinders (13Y2) (13Z2).	L	2 large, 10 small.
	5	.....do	On spring guide rods	S	
	5	.....do	.....do	S	
	2	.....do	On vertical traversing shaft.	S	
	2	.....do	On toggle pin	S	
N20C	2	.....do	Under right-hand scale (N20B).	Bz	
N20K	2	.....do	Under bolts (N20G)	Bz	
U47BD	4	Water buckets	With carriage	Indurated fiber.	Commercial.
	1	Worm wheel	On vertical traversing shaft	Bz. No. 2	
U45AB	1	Wrench	In armament chest	S	For screw driver.
U43Q	3	Wrench (single)	.....do	F. S	For filling plug.

Names of parts of 12-inch mortar carriages, model of 1896 MI and model of 1896 MII, their piece marks, location, and material of which they are made—Continued.

12-INCH MORTAR CARRIAGE, MODEL OF 1896 MII.

[For other parts of MII not listed here, see list of MI parts:]

Piece mark.	No.	Name of part.	Location.	Material.	Remarks.
	1	Angle (in 4 sections)	On edge of racer	S	To protect azimuth circle.
	3	Bolts, countersunk, with nuts.	Ladder to floor plate	S	0.75 by 2.125.
	1	do	Ladder to brace	S	0.75 by 1.875.
	24	Bolts, tap	For traversing rack	S	0.75 by 3.
	16	do	Azimuth circle castings to bracket.	S	0.75 by 2.5.
	32	do	For bushings in top carriage	Bz	0.5 by 1.125.
	4	do	For foot-lever bracket	S	0.625 by 1.75.
	4	do	Bracket to racer	S	1.25 by 3.
	8	Bolts, tap (special)	For cap squares on racer	S	2 by 4.75.
	8	Bolts with nuts	Azimuth circle castings to intermediate angles.	S	1 by 2.5.
	4	Bushings (in halves)	In bearings on racer	Bz. No. 3	2 right, 2 left.
	4	Cap squares	On racer	C. S. No. 1	Do.
	1	Collar	On traversing worm shaft	S	
	1	Core-hole cover	On racer	C I	12 diameter.
	2	Cylinder head	In recoil cylinders	Bz. No. 4	
	1	Oil pipe	In pedestal	Br	
	4	Oil tubes (bent)	In racer	Br	
	8	Oil tubes (straight)	do	Br	
	1	Pedestal	On racer	C. I	
	1	Pedestal cover	On pedestal	C. I	
	2	Pistons	On piston rods	F. S. No. 3	
	2	Piston bushings	do	Bz. No. 4	
	1	Pit ladder (complete)	Under removable floor plate	F. S	
	1	Racer	On base ring	C. S. No. 1	
	2	Recoil cylinders	In bearings on racer	C. S. No. 3	1 right, 1 left.
	1	Removable floor plate	On racer	C. I	
	4	Screws, countersunk	Core-hole cover to racer	Bz	0.5 by 1.5.
	11	do	Floor plate to racer	Bz	0.75 by 2.
	12	do	In racer oil holes	Bz	0.5 by 1.
	80	Screws, countersunk (special).	Angle to racer	S	
	24	Screws (special)	For bushings in racer	Bz	
	1	Split pin	In taper pin	S	
	1	Taper pin	In traversing pinion	S	
	1	Traversing handwheel	On traversing worm shaft	C. I. No. 2	Complete, including handle.
	1	Traversing pinion	On vertical traversing shaft	Bz. 2	
	1	Traversing rack	On base ring	F. S	In 6 sections.
	1	Traversing worm shaft	In pedestal	S	
	1	Vertical traversing shaft	do	F. S. No. 1	

ELECTRICAL EQUIPMENT.

[On drawings 12-12-21 and 12-13-11, Plates VII and XII, are given the locations of the receptacles, plugs, etc., on the carriages and the lengths of slicked reinforced cord and armored cable required. In ordering parts for replacement, the piece mark given in the left-hand column and the name of the part should be stated.]

E25M1	1	Base	For receptacle, E25AB	Cond	
E25M1	1	do	For receptacle, E25J1	Cond	
E25M1	1	do	For receptacle, E25H1	Cond	
E25M1	1	do	For receptacle, E25AF	Cond	
E22L	1	do	For junction box, E22N	Cond	
E21F	1	do	For junction box, E21T	Cond	For 110-volt main.
E21J	1	do	For junction box, E21U	Cond	For 220-volt main.
E22V	1	do	For quadrant lamp bracket, E22P.	Cond	
T95C	1	Base bracket	In bottom of well	F. S	
P57AE	1	Boat snap hook	On mortar	Comm	
P57AF	1	Boat snap hook screw	do	S	
T96H	1	Body	For terminal tube, T96EA	Bz	For magneto, M. A.
	4	Bolts, foundation, with washers and nuts.	For magneto bracket		Furnished by Engineer Department.
T95J	2	Bolts, hex	For receptacle bracket, T95F.	Bz	For 1896 MI only.
E22R	2	Bolts, tap	For quadrant lamp bracket, E22P.	S	0.75 by 1.625.

Names of parts of 12-inch mortar carriages, model of 1896 MI and model of 1896 MII, their piece marks, location, and material of which they are made—Continued.

ELECTRICAL EQUIPMENT—Continued.

Piece mark.	No.	Name of part.	Location.	Material.	Remarks.
T95D	3	Bolts, tap	For base bracket	S	0.75 by 8; 6 std. nuts.
E20C	2	do	For plug box	S	0.25 by 0.875.
T91R	15	do	For straps, T91F	S	For 1896 MI only. 0.5 by 1.
T91R	2	do	For straps, T91Z	S	For 1896 MII only. 0.5 by 1.
T91R	9	do	For straps, T91F	S	For 1896 MII only. 0.5 by 1.
E22Q	1	Bracket	For quadrant lamp bracket, E22P.	Bz	
V23AM	1	Bushing	On plug box	Comm	0.75 by 0.5.
E25AJ	1	do	For cover for receptacle, E25J1.	Cond	
E25AJ	1	do	For receptacle, E25H1	Cond	
T97P	1	Cable terminal	For magneto cable		
T97Q	1	do	do		
E12X	2	Cable thimbles	For slicked cord	G. I	
E13AJ2	1	Candelabra, receptacle	For quadrant lamp	V. A	
E13AJ2	1	do	For azimuth lamp	V. A	
E12NA	2	Candelabra lamps, 8 C. P.	For elevation quadrant and azimuth pointer.	Comm	
E23L	1	Chain	For receptacle, E25AF	Br	No. 2, plumber's.
E23L	1	do	For receptacle, E25H1	Br	Do.
E23L	1	do	For receptacle, E25AB	Br	Do.
E23K	1	Chain pivot	do	Br	
E23K	1	do	For receptacle, E25AF	Br	
E23K	1	do	For receptacle, E25H1	Br	
E22Y	2	Connector links	For quadrant lamp bracket, E22P.	S. C	
E21K	2	Connector strips	For junction box, E21T	S. C	
E25K1	2	do	For receptacle, E25I1	S. C	
E25K1	2	do	For receptacle, E25AB	S. C	
E25K1	2	do	For receptacle, E25AF	S. C	
E21L	1	do	For junction box, E21U	S. C	
E21N	2	do	do	S. C	
E21M	2	do	For junction box, E21T	S. C	
E25S3	1	Contact housing	For plug, E25AA1	Bz	
E25T3	1	do	For plug, E25Z1	Bz	
E25T3	2	do	For plug, E25AD	Bz	
E25Q	4	Contact screws, rd. hd	do	Br	0.138 by 0.125 A. S. M. E. std.
E25Q	2	do	For plug, E25AA1	Br	Do.
E25Q	2	do	For plug, E25Z1	Br	Do.
E25P1	4	Contact strips	For plug, E25AD	C	
E25P1	2	do	For plug, E25Z1	C	
E25P1	2	do	For plug, E25AA1	C	
E25R2	1	Contact terminal	do	Cond	
E25R2	1	do	For plug, E25Z1	Cond	
G25AC1	2	do	For plug, E25AD	Cond	
E22AB	1	Coupling	For quadrant lamp	Bz	
E22AB	1	do	For azimuth lamp	Bz	
E25G	1	Cover	For receptacle, E25AB	Bz	
E25G	1	do	For receptacle, E25AF	Bz	
E25E1	1	do	For receptacle, E25H1	Bz	
E22S	1	do	For quadrant lamp bracket, E22P.	S. B	
E21D	1	do	For junction boxes, E21T or E21U.	Bz	
P65A2	1	do	For cover for receptacle, E25J1.	Bz	
E22C	1	do	For junction box, E22N	S. B	
	1	Expansion hook	In bottom of well	Comm	0.375 by 6.
	1	do	do	Comm	0.375 by 3.5.
T95E	1	Eyebolt	On base bracket	F. S	
E22E	1	Gasket	For junction box, E22N	S. R	0.062 thick.
E23AD	1	do	For plug, E25Z1	S. R	Do.
E23AD	2	do	For plug, E25AD	S. R	Do.
E25D	1	do	For receptacle, E25AB	S. R	Do.
E25D	1	do	For receptacle, E25J1	S. R	Do.
E25D	1	do	For receptacle, E25H1	S. R	Do.
E25D	1	do	For receptacle, E25AF	S. R	Do.
E23M	1	do	do	S. R	Do.
E23M	1	do	For receptacle, E25H1	S. R	Do.
E23M	1	do	For receptacle, E25AB	S. R	Do.
E22U	1	do	For quadrant lamp bracket, E22P.	S. R	Do.

Names of parts of 12-inch mortar carriages, model of 1896 MI and model of 1896 MII, their piece marks location, and material of which they are made—Continued.

ELECTRICAL EQUIPMENT—Continued.

Piece mark.	No.	Name of part.	Location.	Material.	Remarks.
E21C	1	Gasket	For junction box, E21T or E21U.	S. R	0.062 thick.
E23AB1	1	Gland	For receptacle, E25J1	Bz	
E25AB1	2	.....do	For plug, E25AD	Bz	
E23AB1	1	.....do	For plug, E25AA1	Bz	
E23AB1	1	.....do	For plug, E25Z1	Bz	
E22J	1	.....do	For junction box, E22N	Bz	
E21Y1	5	.....do	For terminal tube, E21Z	Bz	
E25W	2	.....do	For terminal tube, E25AE	Bz	
T96GA	1	Gland nut	For terminal tube, T96EA	Bz	For magneto, M. A
E25V	2	Gland rings	For terminal tube, E25AE	Bz	
T96FA	1	.....do	For terminal tube, T96EA	Bz	Do.
E21X	5	.....do	For terminal tube, E21Z	Bz	
E25U	4	Headless screws	For plug, E25AD	Br	
E25U	2	.....do	For plug, E25AA1	Br	
E25U	2	.....do	For plug, E25Z1	Br	
E21A1	1	Junction box	For junction box, E21T or E21U.	Bz	
E22X	1	Lamp fitting	For quadrant lamp	Bz	
E22A1	1	Lamp junction box	For junction box, E22N	Bz	For azimuth lamp.
E12Q1	1	Lamp spring	For azimuth lamp	P. Bz	
E12Q1	1	.....do	For quadrant lamp	P. Bz	
P65C1	1	Lid	For cover for receptacle, E25J1.	Bz	
	1	Magneto, type M. A	Attached to magneto bracket.		
P73D	1	Magneto cable plug	For magneto cable		Furnished by Engineer Department.
77A	1	Magneto bracket	Attached to wall of emplacement.		
E25N1	1	Mica	For receptacle, E25AB		0.1875 by 2 by 0.062 thick.
E25N1	1	.....do	For receptacle, E25J1		Do.
E25N1	1	.....do	For receptacle, E25H1		Do.
E25N1	1	.....do	For receptacle, E25AE		Do.
E21H	1	.....do	For junction box, E21T or E21U.		3.5 diameter by 0.031 thick.
E22BA	1	.....do	For junction box, E22N		1.375 by 1.375 by 0.062 thick.
E22CA	1	.....do	For quadrant lamp bracket E22P.		1.625 by 2.375 by 0.062 thick.
E25AM	4	Nuts, hex	For receptacle, E25AF	Bz	0.190 by 0.2 thick, 0.375 flats.
E25AM	4	.....do	For receptacle, E25AB	Bz	Do.
E25AM	4	.....do	For receptacle, E25H1	Bz	Do.
E25AM	4	.....do	For receptacle, E25J1	Bz	Do.
E22G	4	.....do	For quadrantlamp bracket, E22P.	Br	0.190 by 0.125 high.
E22G	4	.....do	For junction box, E22N	Br	Do.
	2	.....do	On plug chain	Br	Do.
E21S	16	.....do	For junction box, E21T or E21U.	Br	Do.
T95K	2	Nuts, wing	For receptacle bracket, T95F.	Bz	For 1896 MI only, 0.375 std.
	1	Packing	For terminal tube, E25AE	Flax	
	5	.....do	For terminal tube, E21Z	Flax	Square Navy type.
	1	.....do	For receptacle, E25J1	Flax	Do.
E22K	1	.....do	For junction box, E22N	Flax	Do.
E25AK	1	Pin	For cover for receptacle, E25J1.	H. R	
E25AK	1	.....do	For receptacle, E25H1	H. R	
E20B	1	Plug box	On side frame, 1896 MI on racer, 1896 MII.		Furnished by Engineer Department.
E23AC1	2	Plug caps	For plug, E25AD	Bz	
E23AC1	1	.....do	For plug, E25Z1	Bz	
E21E	1	Plumber's chain	For junction box, E21T or E21U.	Br	5 long.
E20A	1	Portable lamp and cable	For plug box, E20B		Furnished by Engineer Department.
	1	Pulley block, double	For base bracket	Comm	0.375 by 1.25 sheave swivel eye.
E25A	1	Receptacle box	For receptacle, E25AB	Bz	
E25B1	1	.....do	For receptacle, E25J1	Bz	
E25A	1	.....do	For receptacle, E25H1	Bz	
E25AG	1	.....do	For receptacle, E25AF	Bz	

Names of parts of 12-inch mortar carriages, model of 1896 MI and model of 1896 MII, their piece marks, location, and material of which they are made—Continued.

ELECTRICAL EQUIPMENT—Continued.

Piece mark.	No.	Name of part.	Location.	Material.	Remarks.
E25G	1	Receptacle bracket	For receptacle bracket, T95F.	Bz	For 1896 MI only.
E23J	1	Receptacle cap	For receptacle, E25J1	Bz	
E23J	1	do	For receptacle, E25H1	Bz	
E23J	1	do	For receptacle, E25AF	Bz	
E23J	1	do	For receptacle, E25AB	Bz	
E12P3	1	Reflector	For azimuth lamp	S. B	
E12P3	1	do	For quadrant lamp	S. B	
P65F	1	Ring	On plug chain	Comm	Galvanized.
	1	Sash chain	For receptacle stud, T95V	Br	For 1896 MII only, 4 inches of 0.187 chain.
	1	do	On boat snap hook	Comm	Brass, No. 3.
E22B	2	Screws, fil. hd	For junction box, E22N	S	0.375 by 1 std.
T95H	2	do	For receptacle bracket, T95F.	Bz	For 1896 MI only, 0.5 by 1.125 std.
E25C	2	do	For receptacle, E25H1	S	0.375 by 0.875 std.
E25C	2	do	For receptacle, E25AB	S	Do.
E25F	2	Screws, flat fil. hd	For receptacle, E25J1	Br	0.164 by 0.45 A. S. M. E. std.
E25F	2	do	For receptacle, E25AB, base	Br	Do.
E25F	4	do	For receptacle, E25H1, cover	Br	Do.
E25F	2	do	For receptacle, E25AF, base	Br	Do.
E25F	2	do	For receptacle, E25H1, base	Br	Do.
E25F	4	do	For receptacle, E25AF, cover.	Br	Do.
E25F	4	do	For receptacle, E25AB, cover.	Br	Do.
E22T	6	do	For quadrant lamp bracket, E22P.	Br	0.190 by 0.5 A. S. M. E. std.
E22M	2	do	For junction box, E22N	S	0.190 by 0.562 A. S. M. E. std.
E22W	4	do	For quadrant lamp bracket, E22P.	S	0.190 by 0.625 A. S. M. E. std.
E23C	4	do	For cover for receptacle, E25J1.	Br	0.164 by 0.437 A. S. M. E. std.
E21B	2	do	For junction box, E21T or E21U.	S	0.375 by 1 std.
E22D	6	do	For junction box, E22N	Br	0.164 by 0.437 A. S. M. E. std.
P45BB	1	do	On terminal for ground connection.	Br	0.25 by 0.5 std.
E21G	2	do	For junction box, E21T or E21U.	Br	0.190 by 0.45 A. S. M. E. std.
	2	Screws, rd. hd	do	Br	0.190 by 0.2 A. S. M. E. std.
	2	do	On plug chain	Br	0.190 by 0.375 A. S. M. E. std.
	2	do	On receptacle stud, T95V	Br	For 1896 MII only, 0.164 by 0.25 A. S. M. E. std.
	2	Split pins	do	Br	For 1896 MII only, 0.156 by 1.
	1	do	On cover for receptacle, E25J1.		0.125 by 1.5.
P65D1	1	Spring	do	S	0.040 wire.
T95A	1	do	Supports slicked cord in well.	Br	No. 13 B. & S. gage.
T91Z	2	Straps	Armored cable to carriage	S	For 1896 MII only.
T91F	9	do	do	S	Do.
T91F	15	do	do	S	For 1896 MI only.
T95W	2	Studs	For receptacle stud, T95V	Bz	For 1896 MII only.
E25X	2	Stuffing tubes	For terminal tube, E25AE.	Bz	
P45AN	1	Terminal	For ground on mortar	C	
E25L1	2	Terminal clips	For receptacle, E25H1	P. Bz	
E25L1	2	do	For receptacle, E25J1	P. Bz	
E25L1	2	do	For receptacle, E25AF	P. Bz	
E25L1	2	do	For receptacle, E25AB	P. Bz	
E25F	2	Terminal screws, flat fil. hd.	For junction box, P22N	Br	0.190 by 0.875 A. S. M. E. std.
E21P	6	do	For junction box, E21T or E21U.	Br	0.190 by 0.75 A. S. M. E. std.
E22Z	4	do	For quadrant lamp bracket, E22P.	Br	0.190 by 0.687 A. S. M. E. std.
E21Q	2	do	For junction box, E21T or E21U.	Br	0.190 by 0.875 A. S. M. E. std.

Names of parts of 12-inch mortar carriages, model of 1896 M1 and model of 1896 M11, their piece marks, location, and material of which they are made—Continued.

ELECTRICAL EQUIPMENT—Continued.

Piece mark.	No.	Name of part.	Location.	Material.	Remarks.
E25AL	4	Terminal screws, flat fil. hd.	For receptacle, E25J1	Bz	0.190 by 0.85 A. S. M. E. std.
E25AL	4	do	For receptacle, E25AF	Br	Do.
E25AL	4	do	For receptacle, E25H1	Bz	Do.
E21W	5	Terminal tubes	For terminal tube, E21Z	Bz	
E21R	8	Washers	For junction box, E21T or E21U.	Br	0.375 diameter by 0.031 thick, 0.193 hole.
E22H	2	do	For junction box E22N	Br	0.375 diameter by 0.031 thick, 0.2 hole.
T95B	2	Wire hooks	On spring supporting slicked cord.	F. S	

AMMUNITION TRUCK, TYPE 12 M. B.

[2 per carriage.]

	1	Adjustable stop	On body	S	
	1	Axle	Under front leg	W. I	
	44	Balls	For caster bearings	S	
	1	Body	Riveted on top of angles	C. S	
	4	Bolts, with nuts	For brake-shaft brackets	S	0.5 by 1.35.
	1	Brake lever	On brake shaft	S	
	1	Brake-lever guide	On rear leg	S	
	1	Brake-lever spring	Between brake lever and crosstie.	S	
	1	Brake shaft	In brake-shaft bracket	S	
	2	Brake-shaft brackets	On front and rear ties	Bz	
	2	Brake shoes	On brake shaft	C. S	
	1	Buffer pin	In front of body	S	
	1	Buffer spring	do	S	
	2	Bushings	In caster wheels	Bz	
	2	do	In wheels for truck	Bz	
	1	Cap	On buffer pin	Bz	
	1	Cap pin	In buffer pin	S	
	2	Casters	In caster brackets	Bz	
	2	Caster ball bearings	On caster	S	Hardened.
	2	Caster brackets	Riveted to rear leg	C. S	1 right, 1 left.
	2	Caster pins	In caster bracket	W. I	
	2	Caster roller pins	In caster	W. I	
	2	Caster wheels	do	S	With rubber tires.
	1	Crosstie	On front and rear ties	S	
	1	Front leg	Under body	S	
	2	Front and rear ties	Between front and rear legs.	S	1 right, 1 left.
	2	Handles	In handle-bar brackets	White oak	
	4	Handle-bar brackets	Riveted to legs	W. I	2 right, 2 left.
	2	Headless bolts	For brake shoes	S	0.5 by 0.75.
	2	Keys	do	S	
	1	do	For brake lever	S	
	1	Loading tray	Riveted to front of body	S. S	
A3D	1	Name plate	On body	Bz	For Nos. 1–62, incl.
A3C	1	do	do	S. B	For No. 62 and above.
	4	Oil plugs	In wheels and shaft bracket	Bz	0.375 standard.
	1	Pin	For adjustable stop	S	
	2	Pins, escutcheon	For name plate, A3D	Br	No. 14.
	1	Rear leg	Under body	S	
	2	Rings	For caster ball bearing	C	
	4	Rivets	For shot-tray shoe	W. I	
	100	do	For body and angles, etc	W. I	
	4	Screws, No. 16, wood	In handle-bar brackets	S	
	2	Screws, round head	For name plate, A3C	Br	0.25.
	1	Set screw	For brake lever	S	
	1	Shot-tray shoe	Riveted to front of loading tray.	Bz	
	2	Side braces	Riveted to body and legs	S	1 right, 1 left.
	2	Split pins	In cap pin	S	
	1	do	In buffer pin	S	
	2	do	For adjustable stop pin	S	
	2	do	For caster pins	S	
	2	do	For caster roller pins	S	
	2	do	In axle	S	
	2	do	In buffer pin	S	
	2	Transoms	Riveted to front and rear legs.	S	
	2	Washers	On axle	S	
	2	Wheels	do	C. S	

Names of parts of 12-inch mortar carriages, model of 1896 M1 and model of 1896 M11, their piece marks, location, and material of which they are made—Continued.

SHOT TONGS.

[1 per carriage.]

Piece mark.	No.	Name of part.	Location.	Material.	Remarks.
A8G	1	Claw, inner	Opposite outer claw	S	In two parts.
A8H	1	Claw, outer	Pivoted on center pin	S	Do.
A8L	1	Dog	do	S	
A8M	1	Pin, center	In claws and dog	S	
A8J	1	Pin, shackle	In shackle and outer claw	S	
	2	Separators	Between two parts of outer claw.	S	Riveted to claw.
	3	do	Between two parts of inner claw.	S	Do.
A8K	1	Shackle	On shackle pin and outer claw.	S	
	2	Split pins	In shackle pin	S	
	2	do	In center pin	S	
	1	Spreader	In outer claw	S	
	1	do	In inner claw	S	

LANYARD ATTACHMENT.

N17G	2	Bolts, with nuts	For pulley bracket (N17K1).	S	
N17L	1	Bridle ring	On lanyard (N17D)	Sp. S	
N17A	1	Button	On end of lanyard (N17D1).	C. S	
N17B1	1	Hook	do	S	
N17D	1	Lanyard (complete)	Through racer to breech of mortar.	Hemp	Including 2 hooks.
N17H1	1	Pulley	In pulley bracket (N17K1).	Bz	
N17K1	1	Pulley bracket	On pit ladder	Bz	
N17F	4	Screws, countersunk	For washer (N17J)	S	0.25 by 0.375.
	1	Split pin	In pulley bracket (N17K1).	S	
N17E	1	Washer	do	S	For pulley.
N17J	1	do	On racer	C. S	For button (N17A).

ELEVATION QUADRANT.

[Details marked * apply to quadrants Nos. 1 to 217, inclusive, only.]

R19T	1	Arm	On bubble housing (R19U).	Bz	
R19C	1	Arm sector	In arm (R19T)	Bz	
R19CA	1	Arm spring *	In worm sector (R19Z)	P. Bz	
R19Q	1	Arm stop screw	In bracket (R19R)	S	
R19R	1	Bracket	On mortar trunnion	Bz	
R19FA	1	Bubble cover	On arm (R19T)	Bz	
R19U	1	Bubble housing	On bracket (R19R)	Bz	
R19X	1	Bubble-housing plug	In bubble housing (R19U)	Bz	
R19EA	1	Bubble-housing retaining screw.	do	S	
R19N	1	Fulcrum pin	do	Bz	
R19E	1	Level vial	do	Glass	
R19J	1	Locking screw (upper)	In worm (R19L)	S	
R19K	1	Locking screw (lower)	do	S	
R19B	1	Micrometer	do	G. S	
R19P	1	Micrometer *	On micrometer lead (R19G)	G. S	
R19F	1	Micrometer adjusting screw.*	For micrometer (R19P)	S	
R19G	1	Micrometer head *	do	G. S	
R19D	1	Micrometer retaining screw.	In arm (R19T)	S	
R19V	1	Index	Under micrometer (R19B)	S	
R19M	1	Index retaining screw	In arm sector (R19C)	S	
	1	Pin	In worm (R19L)	S	0.04 by 0.12 driven.
R19W	2	Screw	For bracket (R19R)	Bz	Required by Cl. 12, Div. 12 and 13.
R19BA	1	Screw spring *	For micrometer (R19P)	P. Bz	
R19AA	2	Screws, with crown nuts.	For bracket (R19R)	Bz	Required by Cl. 12 Div. 15.
R19A	1	Sector spring	In worm sector (R19Z)	P. Bz	
R19DA	1	Washer	On worm (R19L)	S	
R19S	2	Washers *	For micrometer head (R19G).	G. S	
R19L	1	Worm	In arm sector (R19C)	S	
R19H	1	Worm nut	On worm (R19L)	Bz	
R19Z	1	Worm sector	In arm (R19T)	Bz	

Names of parts of 12-inch mortar carriages, model of 1896 MI and model of 1896 MII, their piece marks, location, and material of which they are made—Continued.

GREASE CUP.

[2 per carriage.]

Piece mark.	No.	Name of part.	Location.	Material.	Remarks.
A2A	1	Body	Screwed into carriage	Bz	
A2B	1	Cap	On upper end of body (A2A).	Bz	
A2D1	1	Cup leather	Underneath plunger (A2E1).	Leather	
	2	Gaskets	Underneath body (A2A)	C	
	1	Pin	In plunger (A2E1)	Bz	0.125 by 0.5 driven.
A2E2	1	Plunger	In body (A2A)	Bz	
A2J	1	Plunger nut	On plunger (A2E1)	Bz	
A2H	1	Screw	Cup leather to plunger	Bz	
	1	Split pin	For plunger and plunger nut.	S	
A2F	1	Spring	Between cap (A2B) and plunger (A2E1).	S	
A2C1	1	Washer	Undercup leather (A2D1)	Bz	

Approximate weights of principal parts of 12-inch mortar carriages, model of 1896 MI and model of 1896 MII, as prepared for shipment.

Number of loose pieces, crates, or boxes.		Contents of each package.		Weight (pounds).	Remarks.
		Number of parts.	Name of parts.		
1	Box	8	Azimuth circle brackets	690	
1	do	4	Azimuth circle sections	2,210	
1	do	4	Azimuth circle sections, with 16 angles for platform.	2,270	
1	Loose	1	Base ring, traversing rack, and tap bolts	17,060	12 bolts for 1896 MI, 24 for 1896 MII.
1	Box	40	Counter-recoil springs (20 small, 20 large), with 5 spring guide rods and 10 nuts for spring guide rods.	4,260	
2	Crates	3	Distance ring sections (each crate 1,820 pounds)	3,640	
4	do	4	Floor plates (each crate 685 pounds)	2,740	
1	Loose	1	Racer	[1] 32,430	For 1896 MI.
				[2] 38,380	Do.
				[2] 33,315	For 1896 MII.
2	do	1	Side frames, with 2 cap squares (each frame 3,600 pounds).	7,200	For 1896 MI only.
1	Box	2	Spring box brackets	2,730	
1	do	1	Spring box	1,725	
1	Loose	1	Top carriage, complete	5,875	
4	Boxes	6	Traversing rollers (each box 880 pounds)	3,520	
1	Box	1	Traversing shaft pedestal, with cover, 8 cover screws and worm wheel.	915	

[1] Cast iron. [2] Cast steel.

Weight of largest package in which remaining parts of carriages are shipped is 2,500 pounds.

Total weights of carriages prepared for shipment:

Model of 1896 MI—	Pounds.
With cast-iron racer	96,775
With cast-steel racer	102,725
Model of 1896 MII	90,718

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ORDNANCE,
Washington, January 11, 1916.

Apr. 22, 1909.
Revised March 18, 1913.
Revised January 11, 1916.
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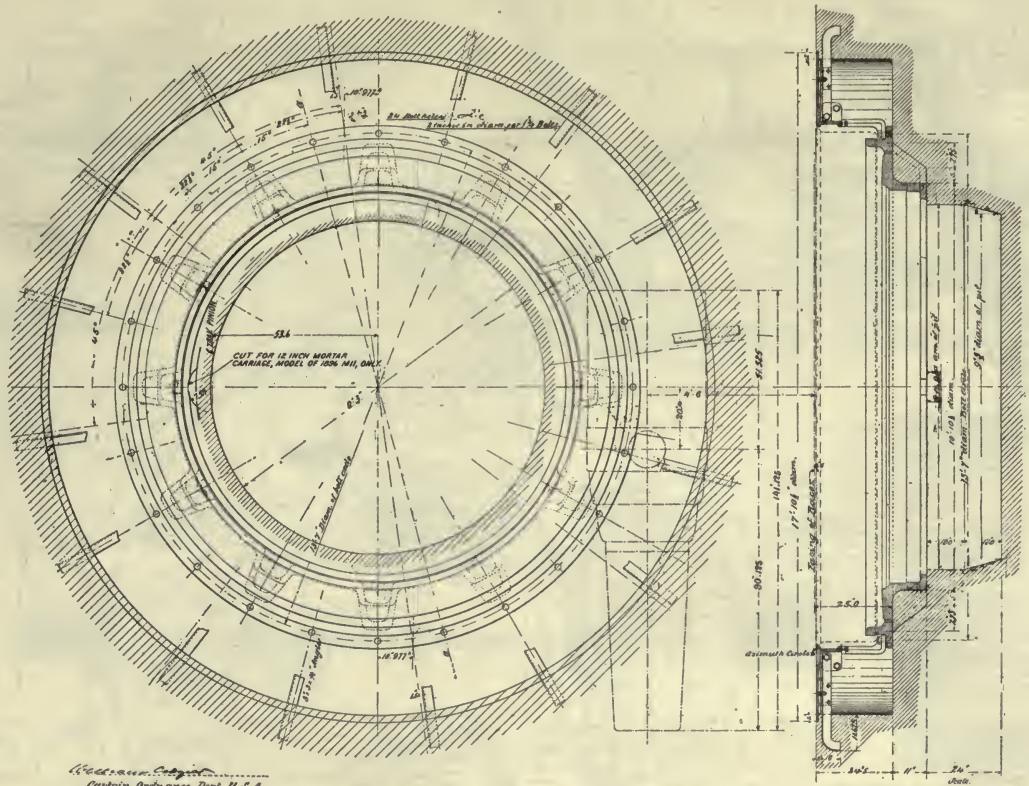
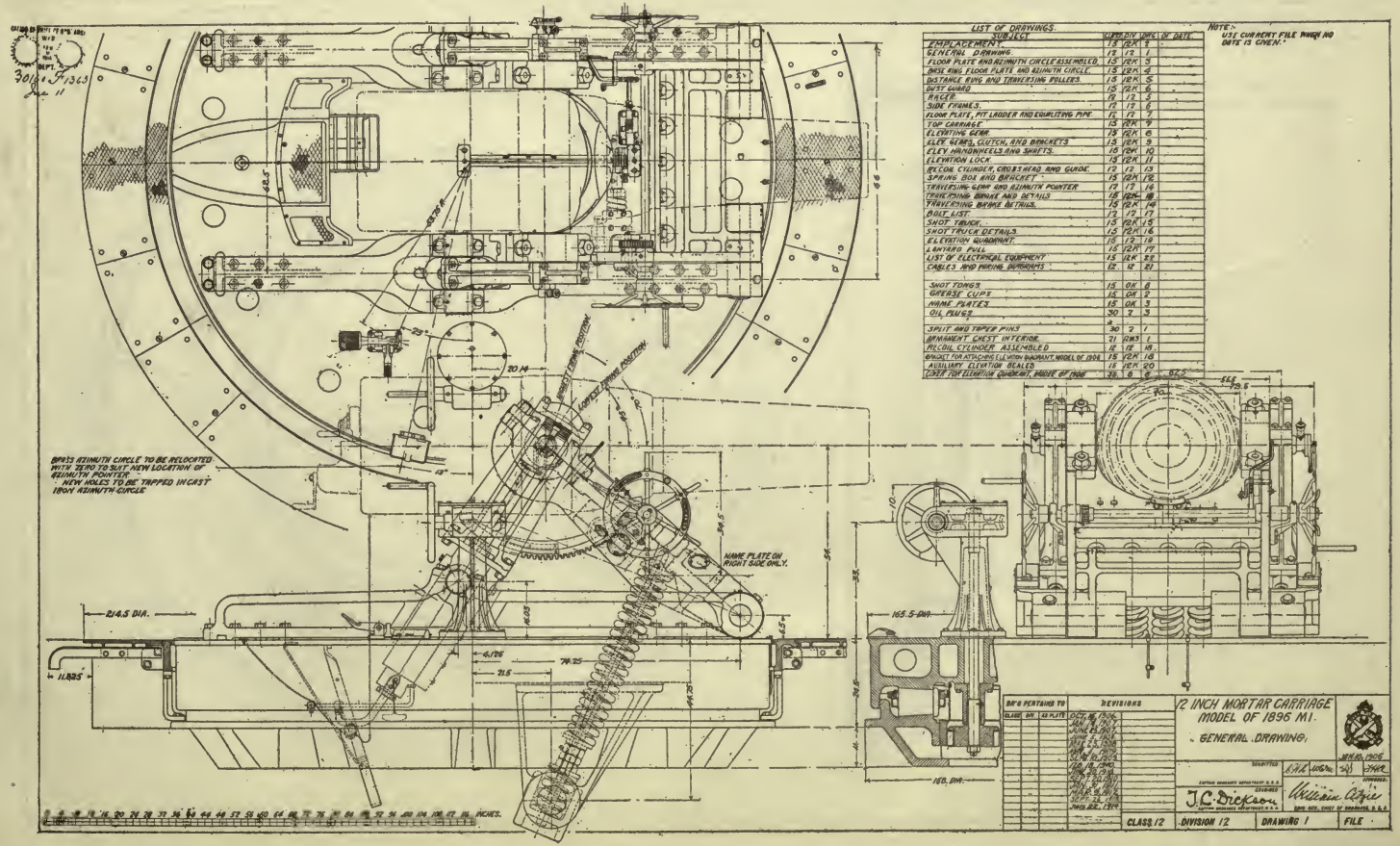
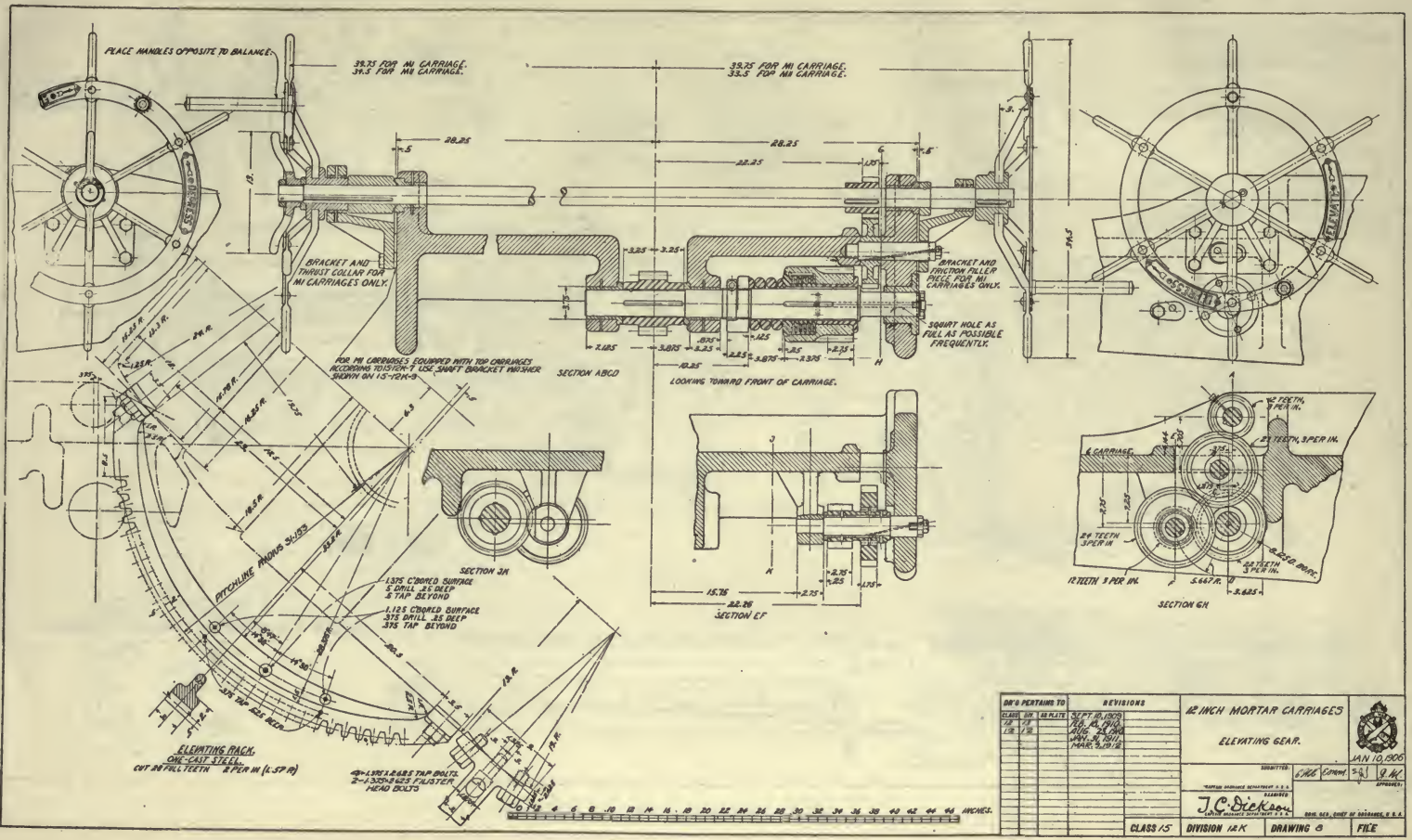
9977—17—4


CUT FOR 12 INCH MORTAR CARRIAGE, MODEL OF 1896, MII, ONLY.
Axis of Trunnions
Axis of Barbette
Axis of Pivot
Azimuth Circle
Face of Parapet
Axis of Bore
Axis of Trunnions
Axis of Pivot
Axis of Barbette
Axis of Bore
Azimuth Circle
Face of Parapet


LIST OF DRAWINGS.
SUBJECT
EMPLACEMENT
GENERAL DRAWING
FLOOR PLATE AND AZIMUTH CIRCLE ASSEMBLED
BASE RING FLOOR PLATE AND AZIMUTH CIRCLE
DISTANCE RING AND TRAVERSING ROLLERS
DUST GUARD
RACER
SIDE FRAMES
FLOOR PLATE, PIT LADDER AND EQUALIZING PIPE
TOP CARRIAGE
ELEVATING GEAR
ELEV. GEARS, CLUTCH, AND BRACKETS
ELEV. HANDWHEELS AND SHAFTS
ELEVATION LOCK
RECOIL CYLINDER, CROSS HEAD AND GUIDE
SPRING BOX AND BRACKET
TRAVERSING GEAR AND AZIMUTH POINTER
TRAVERSING BRAKE AND DETAILS
TRAVERSING BRAKE DETAILS
BOLT LIST
SHOT TRUCK
SHOT TRUCK DETAILS
ELEVATION QUADRANT
LANYARD PULL
LIST OF ELECTRICAL EQUIPMENT
CABLES AND FIRING DIAGRAMS
SHOT TONGS
GREASE CUPS
NAME PLATES
OIL TAGS
SPLIT AND TAPER PINS
ARMAMENT CHEST INTERIOR
RECOIL CYLINDER ASSEMBLED
BRACKET FOR ATTACHING ELEVATION QUADRANT, MODEL OF 1906
AUXILIARY ELEVATION SCALES
CASE FOR ELEVATION QUADRANT, MODEL OF 1906
NOTE:- USE CURRENT FILE WHEN NO DATE IS GIVEN.
BRASS AZIMUTH CIRCLE TO BE RELOCATED WITH ZERO TO SUIT NEW LOCATION OF AZIMUTH POINTER
NEW HOLES TO BE TAPPED IN CAST IRON AZIMUTH CIRCLE
NAME PLATE ON RIGHT SIDE ONLY.
214.5 DIA.
165.5 DIA.
165. DIA.
INCHES.
12 INCH MORTAR CARRIAGE MODEL OF 1896 M1.
GENERAL DRAWING.
CLASS 12
DIVISION 12
DRAWING 1
FILE


PLACE HANDLES OPPOSITE TO BALANCE.
39.75 FOR M1 CARRIAGE.
39.5 FOR M8 CARRIAGE.
28.25
22.25
BRACKET AND THRUST COLLAR FOR M1 CARRIAGES ONLY.
BRACKET AND FRICTION FILLER PIECE FOR M1 CARRIAGES ONLY.
SQUIRT HOLE AS FULL AS POSSIBLE FREQUENTLY.
FOR M1 CARRIAGES EQUIPPED WITH 700 CARRIAGES ACCORDING TO 1915-CM-7 USE SHAFT BRACKET WASHER SHOWN ON 15-12K-9.
SECTION ABCD
LOOKING TOWARD FRONT OF CARRIAGE.
SECTION JK
PITCHLINE RADIUS 31.153
.375 C'BORED SURFACE .5 DRILL .25 DEEP & TAP BEYOND
1.125 C'BORED SURFACE .375 DRILL .25 DEEP .375 TAP BEYOND
ELEVATING RACK. ONE-CAST STEEL. CUT 36 FULL TEETH 8 PER IN (1.57 P)
1.375 X 0.625 TAP BOLTS. 2-1.375 X 0.625 PLASTER HEAD BOLTS
SECTION EF
15.75
22.26
12 TEETH 3 PER IN.
24 TEETH 3 PER IN.
42 TEETH 3 PER IN.
27 TEETH, 3 PER IN.
SECTION GH
INCHES.

DR'G PERTAINS TO			REVISIONS
CLASS	DIV.	SR PLATE	
12	K		SEPT 10, 1909.
12	K		FEB. 18, 1910.
			JUNE 24, 1910.
			JAN. 31, 1911.
			MARCH 9, 1912.

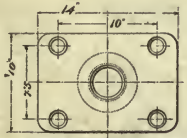
12 INCH MORTAR CARRIAGES

ELEVATING GEAR.

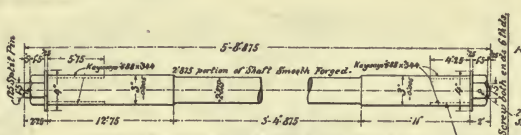
JAN 10, 1906

SUBMITTED: CAPTAIN ORDNANCE DEPARTMENT U.S.A. — APPROVED: J. C. DICKSON, CAPTAIN ORDNANCE DEPARTMENT U.S.A. — BRIG. GEN., CHIEF OF ORDNANCE, U.S.A.

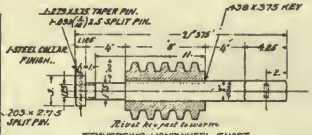
CLASS 15 | DIVISION 12K | DRAWING 8 | FILE



1 Bracket, for Vert. Shaft, Cast Iron, Bushing of Bronze.

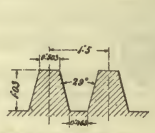


1 Vertical Traversing Shaft 2 Nuts 4 2 Washers of Steel.

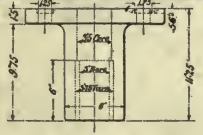


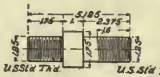
TRAVERSING HANDWHEEL SHAFT
ONE - FORGED STEEL - FINISH

TRAVERSING WORM
ONE - FORGED STEEL - FINISH.
1.5 CIRC. PITCH. LEFT HAND DOUBLE THREAD.

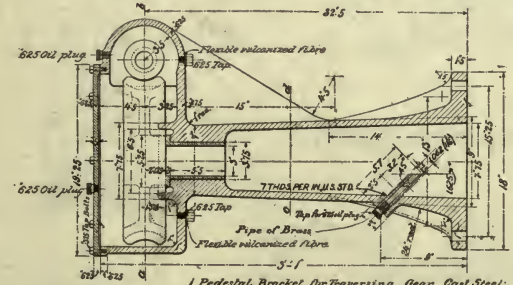


Detail of Worm Teeth.

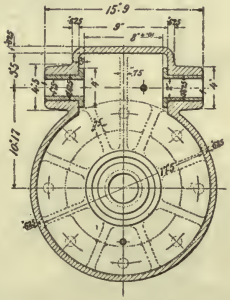




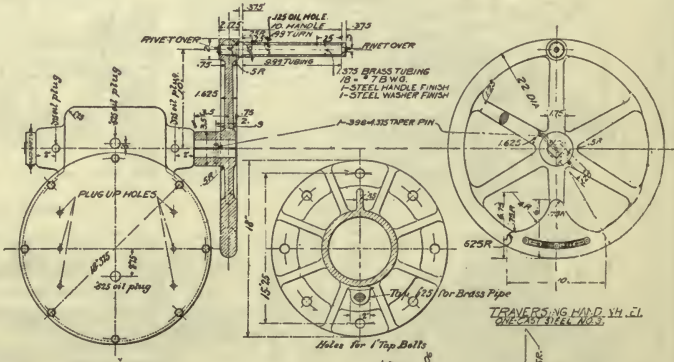
4 Vert. Shaft Bracket Studs, Steel



1 Pedestal Bracket for Traversing Gear Cast Steel:
Bronze Bushings pressed in

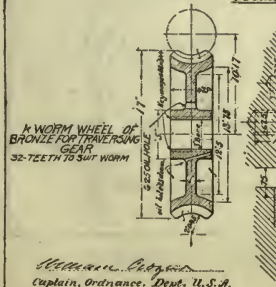


Section on A.B.

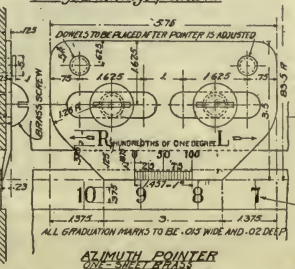


Plan of Cover

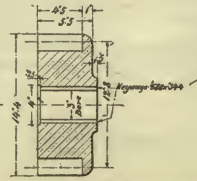
NAME PLATE
ONE - BRONZE
RAISED LETTERS AND EDGES TO BE POLISHED AND BACKS PAINTED THE COLOR OF HAND WHEEL



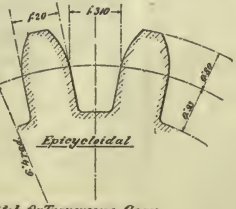
1 Worm Wheel of BRONZE FOR TRAVERSING GEAR
32 TEETH TO SUIT WORM



AZIMUTH POINTER
ONE - SHEET BRASS



1 Pinion, Bronze, 16 teeth P.25 dia. pitch, for Traversing Gear
Cast.



Epicycloidal

12INCH MORTAR CARRIAGE
MODEL OF 1896, MI
TRAVERSING GEAR AND AZIMUTH POINTER

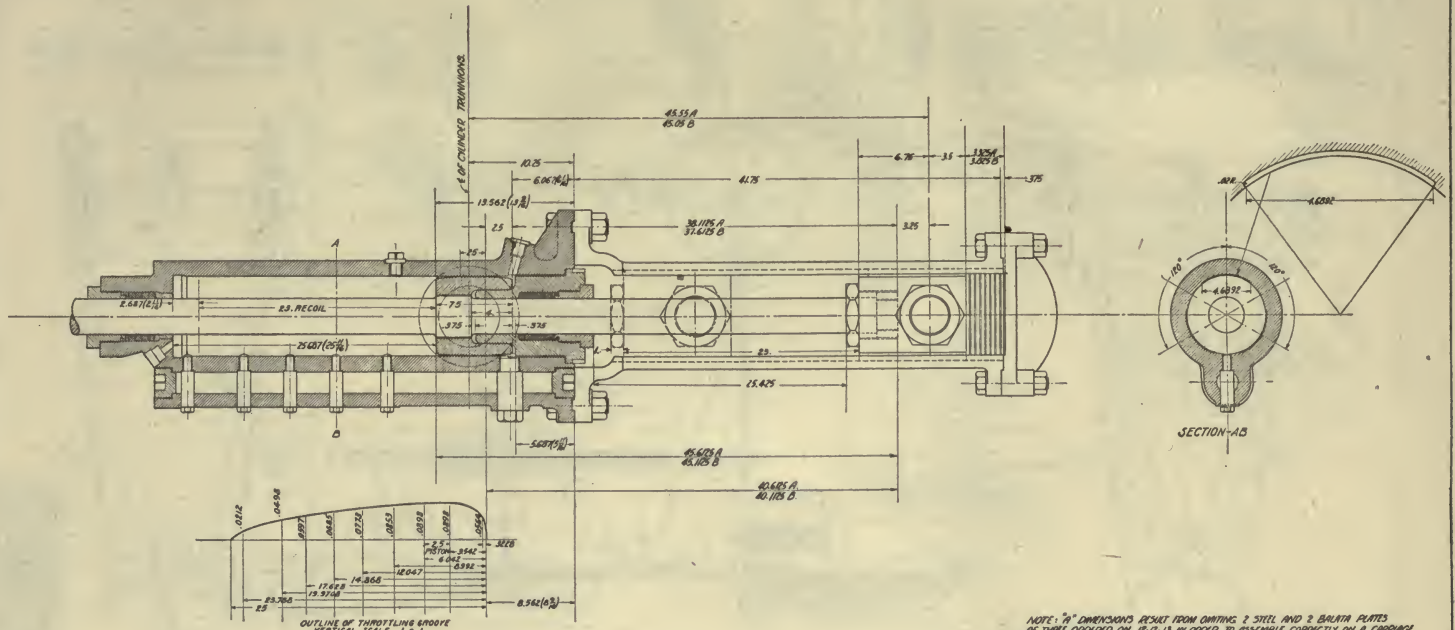
Approved

Brigadier General
Chief of Ordnance

Captain, Ordnance Dept. U.S.A.
Sandy Hook Proving Ground, June 30th 1896

Revised, April 1st & May 5th 1897. May 26th 97. Feb 25th 98. June 1st 98. May 25th 99. Dec 2, 1903. Sept 6, 1904. Jan 10th 1906. FEB 18, 1908. SEPT 8, 1908. JAN. 31, 1911. JULY 5, 1911.

Class 12 | Division 12 | Drawing 14 | File



NOTE: "A" DIMENSIONS RESULT FROM OMITING 2 STEEL AND 2 BALATA PLATES OF THREE ODDLEGS ON 12-12-13 IN ORDER TO ASSEMBLE CORRECTLY ON A CARRIAGE, HAVING STEEL SPACER WITHOUT SIDE FRAMES AND ALSO HAVING TOP CARRIAGE WITH CRANK PINS .125 BELOW TRUNNIONS.
"B" DIMENSIONS APPLY TO ALL OTHER MODIFIED CARRIAGES.

DRG PERTAINS TO		REVISIONS
CLASS	DIV.	AS PLATE
		NOV. 8, 1907.
		SEPT. 1, 1908.
		NOV. 24, 1908.
		MAY 8, 1909.
		FEB. 10, 1910.

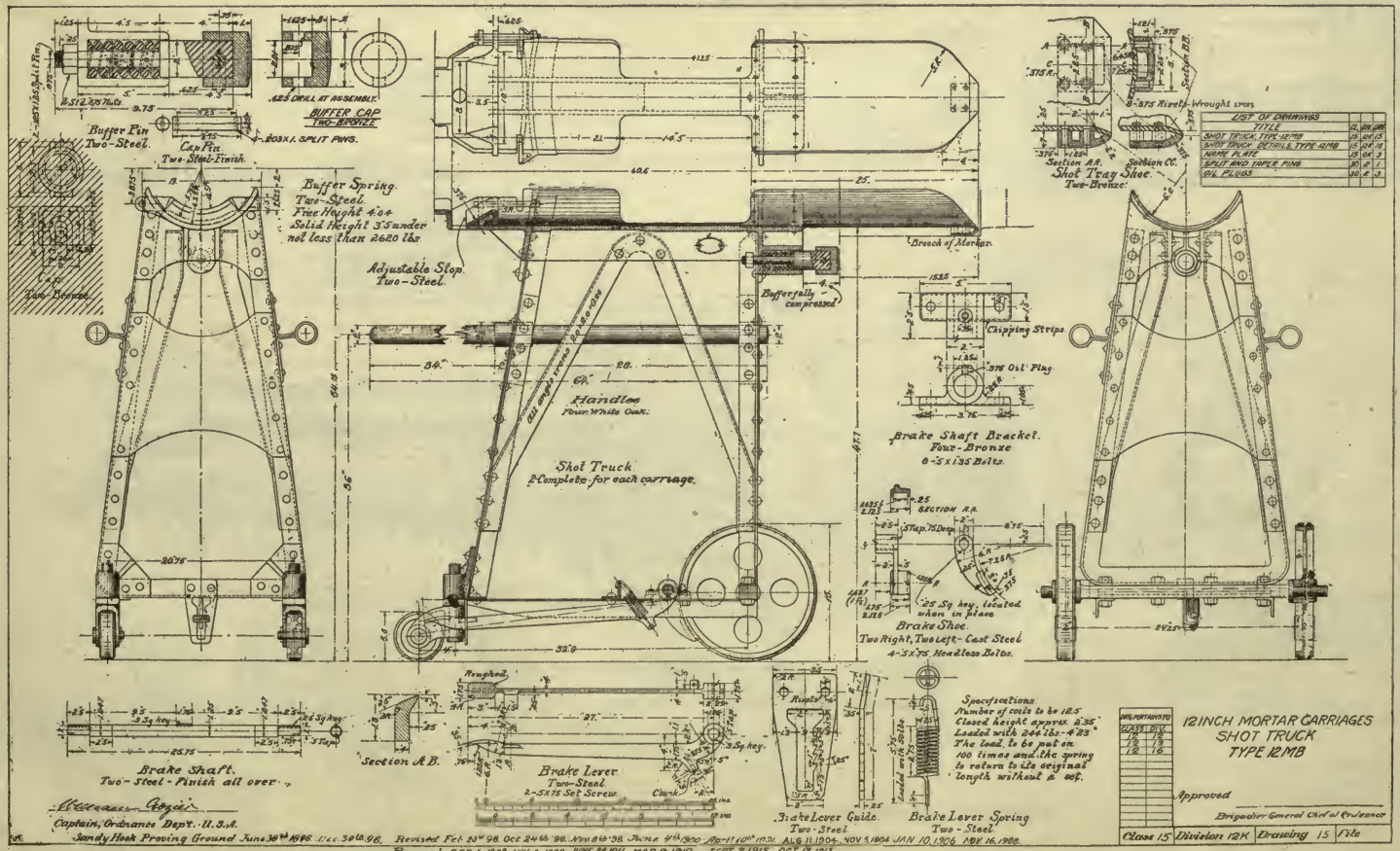
12 INCH MORTAR CARRIAGE
MODEL OF 1896 M1
RECOIL CYLINDER ASSEMBLED

JUNE 25/1907.

DRAWN BY: aac | TRACED BY: A.S.M. | BLUE PRINTED BY: aac | CHECKED BY: aac

APPROVED: [signature]

CLASS 12	DIVISION 12	DRAWING 18	FILE



LIST OF DRAWINGS		
TITLE	No.	Date
SHOT TRUCK, TYPE 12 MB	15	Oct 15
SHOT TRUCK, DETAILS, TYPE 12 MB	15	Oct 16
NAME PLATE	15	Oct 3
SPLIT AND TAPER PINS	30	Dec 1
OIL PLUGS	30	Dec 3

SHELL PORTAVIS TO	
CLASS	DIV.
13	13
12	16

12 INCH MORTAR CARRIAGES
SHOT TRUCK
TYPE 12 MB

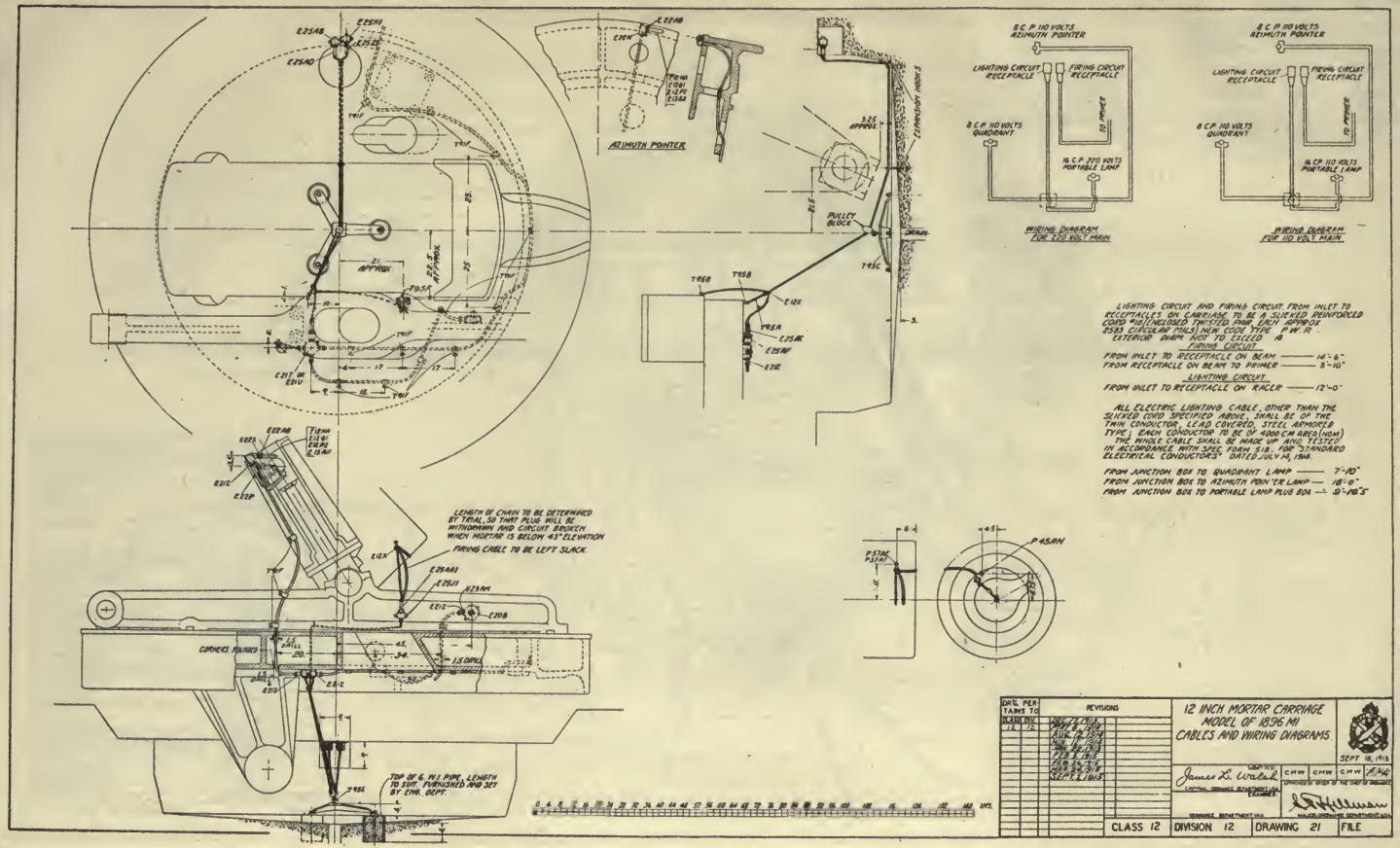
Approved

Brigadier General Chief of Ordnance

Captain, Ordnance Dept. U.S.A.

Sandy Hook Proving Ground June 30th 1898. Dec 30th 98. Revised Feb 28th 98 Oct 24th 98. Nov 8th 98 June 9th 1900 Apr 11th 1901 AUG 11 1904 NOV 5 1904 JAN 10, 1906 NOV 16, 1906.
Revised FEB. 6, 1909. NOV 3, 1909. JUNE 28, 1911. MAR. 9, 1912. SEPT. 2, 1913. OCT. 17, 1913.

Class 15 | Division 12K | Drawing 15 | Title


AZIMUTH POINTER
WIRING DIAGRAM FOR 220 VOLT MAIN
WIRING DIAGRAM FOR 110 VOLT MAIN
LENGTH OF CHAIN TO BE DETERMINED BY TRIAL, SO THAT PLUG WILL BE WITHDRAWN AND CIRCUIT BROKEN WHEN MORTAR IS BELOW 43° ELEVATION
FIRING CABLE TO BE LEFT SLACK.
TOP OF 6 IN I PIPE, LENGTH TO SUIT, FURNISHED AND SET BY ENG. DEPT.
PULLEY BLOCK
CARRIAGE HOOKS
525 APPROX.
21 APPROX
25.5 APPROX
DRILL 20.
1.5 DRILL
COUNTER BORED
8 C.P. 110 VOLTS QUADRANT
LIGHTING CIRCUIT RECEPTACLE
FIRING CIRCUIT RECEPTACLE
10 PRIMER
16 C.P. 220 VOLTS PORTABLE LAMP
16 C.P. 110 VOLTS PORTABLE LAMP

LIGHTING CIRCUIT AND FIRING CIRCUIT, FROM INLET TO RECEPTACLES ON CARRIAGE, TO BE A SLICKED REINFORCED CORD #16 (TINSELED TWISTED TAPE, EACH APPROX 2583 CIRCULAR MILS) NEW COOK TYPE P.W.R. EXTERIOR DIAM NOT TO EXCEED .8

FIRING CIRCUIT

FROM INLET TO RECEPTACLE ON BEAM ——— 14'-6"
FROM RECEPTACLE ON BEAM TO PRIMER ——— 3'-10"

LIGHTING CIRCUIT

FROM INLET TO RECEPTACLE ON RACER ——— 12'-0"

ALL ELECTRIC LIGHTING CABLE, OTHER THAN THE SLICKED CORD SPECIFIED ABOVE, SHALL BE OF THE TWIN CONDUCTOR, LEAD COVERED, STEEL ARMORED TYPE; EACH CONDUCTOR TO BE OF 4000 C.M. AREA (NOM.) THE WHOLE CABLE SHALL BE MADE UP AND TESTED IN ACCORDANCE WITH SPEC. FORM 518, FOR "STANDARD ELECTRICAL CONDUCTORS" DATED JULY 14, 1908.

FROM JUNCTION BOX TO QUADRANT LAMP ——— 7'-10"
FROM JUNCTION BOX TO AZIMUTH POINTER LAMP — 18'-0"
FROM JUNCTION BOX TO PORTABLE LAMP PLUG BOX — 9'-10.5"

DATE PERTAINS TO		REVISIONS
YEAR	DIV.	
12	12	DEC. 14, 1912 — ADDED 16 C.P. 110 V. PORTABLE LAMP
		AUG. 28, 1914 — ADDED 8 C.P. 110 V. QUADRANT
		NOV. 19, 1914 — ADDED 10 PRIMER
		JAN. 22, 1915 — ADDED 8 C.P. 110 V. AZIMUTH POINTER
		FEB. 8, 1915
		MAR. 24, 1916
		MAR. 24, 1916
		SEPT. 18, 1918

12 INCH MORTAR CARRIAGE MODEL OF 1896 M1 CABLES AND WIRING DIAGRAMS

SEPT 18, 1918

DRAWN BY: James L. Walsh — CHW — CHW — CHW — APPROVED BY ORDER OF THE CHIEF OF ORDNANCE

CHIEF, ORDNANCE DEPARTMENT, U.S. ARMY

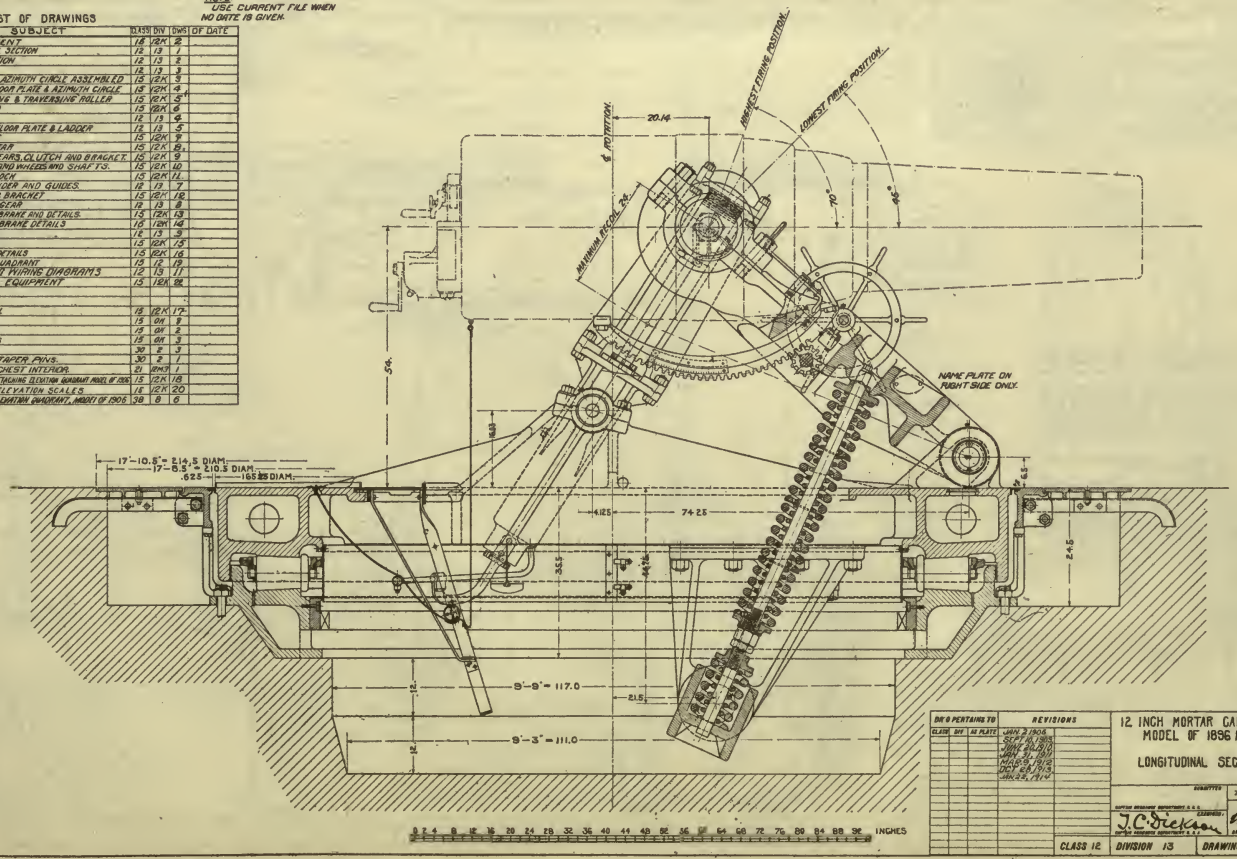
ORDNANCE DEPARTMENT, U.S.A. — WAR DEPARTMENT, ORDNANCE DEPARTMENT, U.S.A.

CLASS 12 | DIVISION 12 | DRAWING 21 | FILE

NOTE:- USE CURRENT FILE WHEN NO DATE IS GIVEN.

LIST OF DRAWINGS

SUBJECT	CLASS	DIV	DWG	OF DATE
EMPLACEMENT	12	12K	2	
LONGITUDINAL SECTION	12	13	1	
REAR ELEVATION	12	13	2	
PLAN	12	13	3	
FLOOR PLATE & AZIMUTH CIRCLE ASSEMBLED	13	12K	3	
BASE RING FLOOR PLATE & AZIMUTH CIRCLE	13	12K	4	
DISTANCE RING & TRAVERSING PULLEY	13	12K	5	
DUST GUARD	13	12K	6	
RACER	12	13	4	
REMOVABLE FLOOR PLATE & LADDER	12	13	5	
TOP CARRIAGE	13	12K	9	
ELEVATING GEAR	13	12K	8	
ELEVATING SCARS, CLUTCH AND BRACKET	13	12K	9	
ELEVATING HAND WHEELS AND SHAFTS	13	12K	10	
ELEVATION LOCK	13	12K	11	
RECOIL CYLINDER AND GUIDES	12	13	7	
SPRING BOX & BRACKET	13	12K	12	
TRAVERSING GEAR	12	13	8	
TRAVERSING BRAKE AND DETAILS	13	12K	13	
TRAVERSING BRAKE DETAILS	13	12K	14	
BOLT LIST	12	13	9	
SHOT TRUCK	13	12K	15	
SHOT TRUCK DETAILS	13	12K	16	
ELEVATION QUADRANT	13	12	19	
CABLES AND PIPING DIAGRAMS	12	13	11	
ELECTRICAL EQUIPMENT	13	18K	22	
LANYARD PULL	13	12K	17	
SHOT TONGS	15	01	9	
GREASE CUP	13	01	2	
NAME PLATES	13	01	3	
OIL PLUGS	30	2	3	
SPLIT AND TAPER PINS.	30	2	1	
ARMAMENT CHEST INTERIOR.	21	01K3	1	
BRACKET FOR ATTACHING ELEVATION QUADRANT MODEL OF 1906	13	12K	18	
AUXILIARY ELEVATION SCALES	16	12K	20	
COVER FOR ELEVATION QUADRANT, MODEL OF 1906	38	8	6	



DR'G PERTAINS TO		REVISIONS
CLASS	DIV	NO. PLATE
		JAN. 2 1906
		SEPT. 10 1906
		JUNE 20 1910
		MAY 6 1910
		MAR. 31 1913
		OCT. 28 1913
		JAN. 23 1914

12 INCH MORTAR CARRIAGE
MODEL OF 1896 MII

LONGITUDINAL SECTION

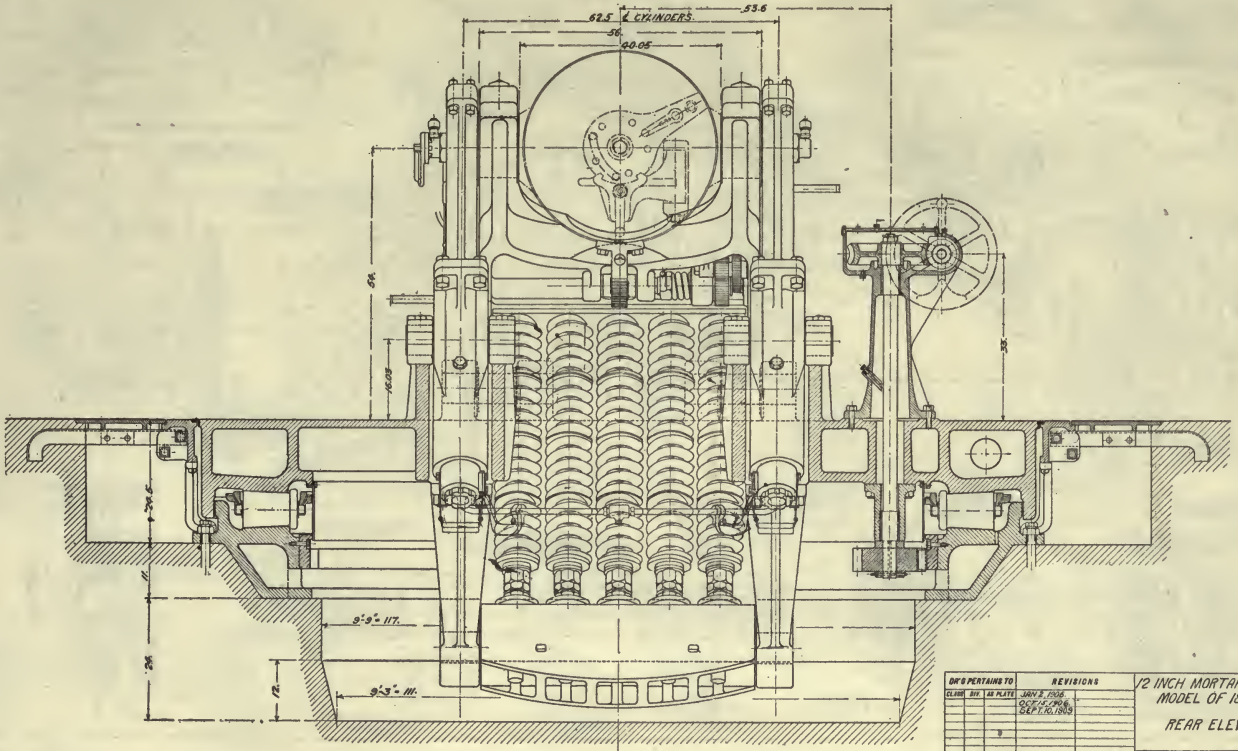
OCT. 16, 1905.

SUBMITTED Z.M. Z.M.

APPROVED

CHIEF OF ORDNANCE, U.S.A.

CLASS 12 | DIVISION 13 | DRAWING 1 | FILE



DR'G PERTAINS TO				REVISIONS
CLASS	DIV.	AS PLATE		JAN'Y 3, 1906. OCT'R 15, 1906. DEC'R 10, 1909.

12 INCH MORTAR CARRIAGE
MODEL OF 1896 MII

REAR ELEVATION.

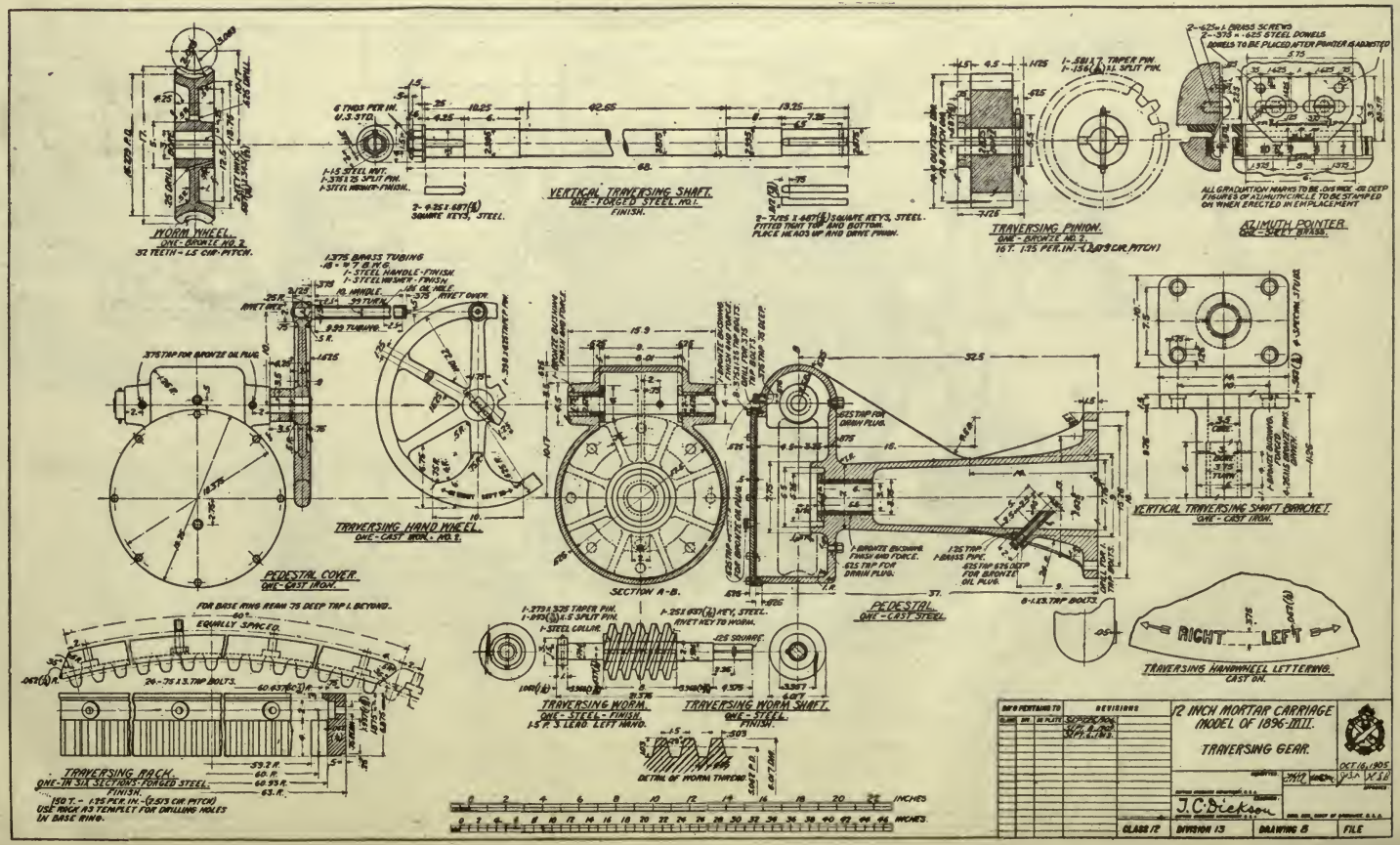
OCT. 16, 1905.

SUBMITTED: [illegible]

EXAMINED: J.C. Dickson, CAPTAIN ORDNANCE DEPARTMENT, U.S.A.

APPROVED: William Crozier, BRIG. GEN., CHIEF OF ORDNANCE, U.S.A.

CLASS 12 | DIVISION 13 | DRAWING 2 | FILE


WORM WHEEL.
ONE - BRONZE NO. 2.
32 TEETH - 1.5 CHP. PITCH.
VERTICAL TRAVERSING SHAFT.
ONE - FORGED STEEL. NO. 1.
FINISH.
TRAVERSING PINION.
ONE - BRONZE NO. 2.
16 T. 1.125 PER. IN. (2.5 CIR. PITCH)
AZIMUTH POINTER
ONE - SHEET BRASS.
TRAVERSING HAND WHEEL
ONE - CAST IRON. NO. 9.
PEDESTAL COVER.
ONE - CAST IRON.
SECTION A-B.
PEDESTAL
ONE - CAST STEEL.
VERTICAL TRAVERSING SHAFT BRACKET.
ONE - CAST IRON.
TRAVERSING HANDWHEEL LETTERING.
CAST ON.
RIGHT
LEFT
TRAVERSING RACK.
ONE-IN SIX SECTIONS-FORGED STEEL.
FINISH.
150 T. - 1.25 PER IN. - (2.5/3 CIR. PITCH)
USE RACK AS TEMPLET FOR DRILLING HOLES IN BASE RING.
TRAVERSING WORM.
ONE - STEEL - FINISH.
1.5 P. S. LEAD. LEFT HAND.
TRAVERSING WORM SHAFT.
ONE - STEEL.
FINISH.
DETAIL OF WORM THREAD.
EQUALLY SPACED.
24 - .75 Ø S. TAP BOLTS.
6 THDS PER IN.
Ø 3.3 STD.
1-.15 STEEL KEY.
1-.3761.25 SPLIT PIN.
1-STEEL WASHER-FINISH.
2-.625 Ø (5/8) SQUARE KEYS, STEEL.
2-.75 Ø 1.687 (1 11/16) SQUARE KEYS, STEEL.
FITTED TIGHT TOP AND BOTTOM.
PLACE HEADS UP AND DRIVE FINISH.
1-.5617 TAPER PIN.
1-.156 (5/32) SPLIT PIN.
2-.625 Ø BRASS SCREWS.
2-.375 Ø - .625 STEEL DOWELS.
DOWELS TO BE PLACED AFTER POINTER IS ADJUSTED
ALL GRADUATION MARKS TO BE .015 WIDE .01 DEEP
FIGURES OF AZIMUTH CIRCLE TO BE STAMPED
ON WHEN ERECTED IN EMPLACEMENT
.375 BRASS TUBING
.49 = 9.7 Ø M. G.
1-STEEL HANDLE - FINISH.
1-STEEL HANDLE - FINISH.
.375 TAP FOR BRONZE OIL PLUG.
.625 TAP FOR DRAIN PLUG.
.875 TAP FOR BRONZE OIL PLUG.
1-BRONZE BUSHING FINISH AND FORCE.
1.25 TAP FOR BRASS PIPE.
1-.2731.325 TAPER PIN.
1-.093 (3/32) S. S. SPLIT PIN.
1-STEEL COLLAR.
1-.25 Ø 1.687 (1 11/16) KEY, STEEL.
RIVET KEY TO WORM.
.05 SQUARE
8-1.125 TAP BOLTS.
INCHES
INCHES

INFORMATION PERTAINING TO		REVISIONS		
CLASS	DIV.	DESCRIPTION	DATE	APPROVED
		SCALE CHANGED	SEPT. 4, 1903.	

12 INCH MORTAR CARRIAGE
MODEL OF 1896-MII.

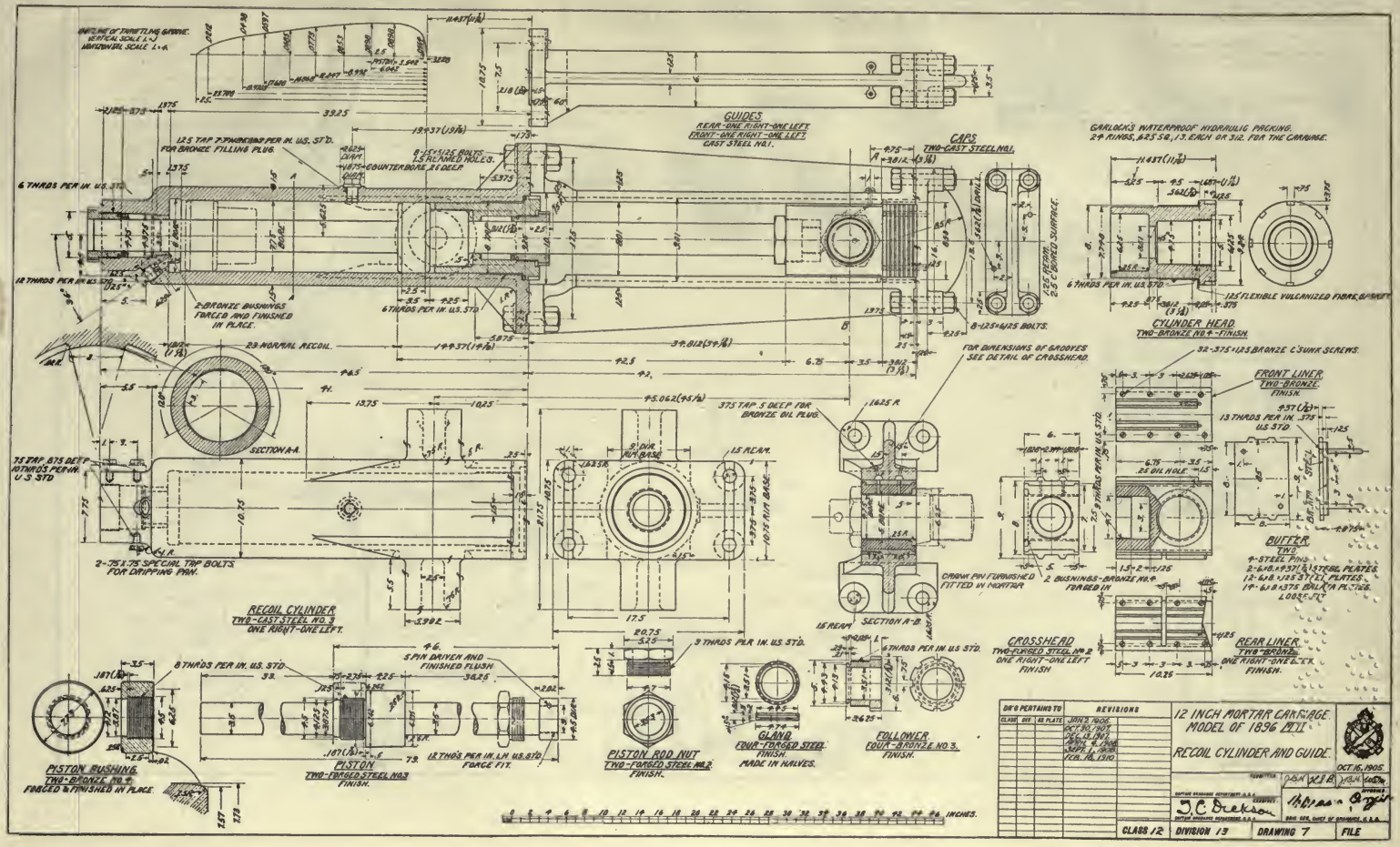
TRAVERSING GEAR.

DRAWN: J.W.D. CHKD: J.S.A. APPROVED: W.S.B.

DATE: OCT. 16, 1905

J. C. Dickson
CHIEF OF ORDNANCE, U.S.A.

CLASS 12 | DIVISION 13 | DRAWING 8 | FILE



DR'G PERTAINS TO	REVISIONS
CLASS DIV. NO. PLATE	JAN. 2, 1906.
	OCT. 30, 1907.
	DEC. 28, 1907.
	APRIL 6, 1908.
	SEPT. 1, 1909.
	FEB. 16, 1910.

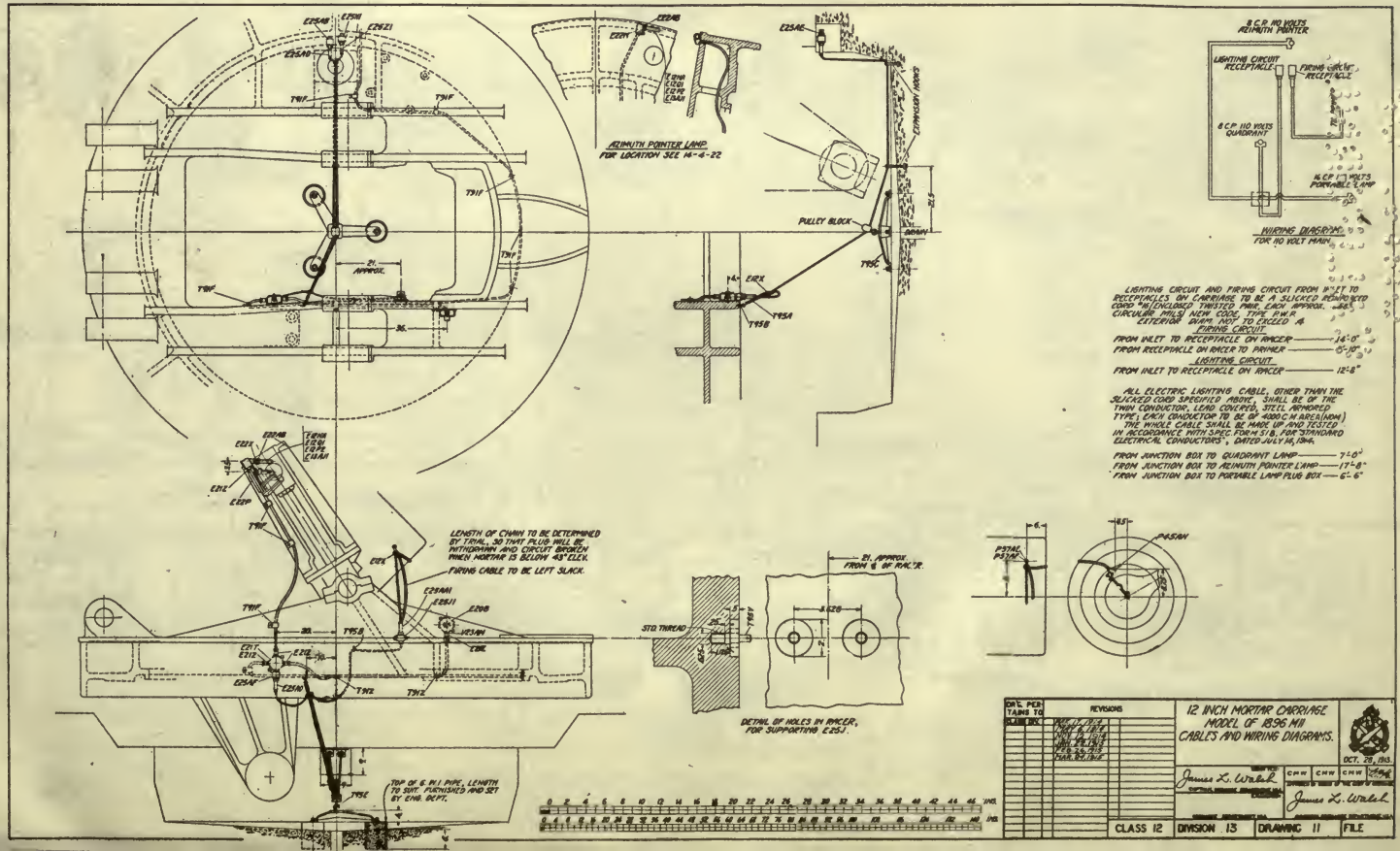
12 INCH MORTAR CARRIAGE.
MODEL OF 1896 MII.
RECOIL CYLINDER AND GUIDE.

OCT. 16, 1905.

DRAWN W.F.R. TRACED W.F.R. TRACING VERIFIED

APPROVED
J.C. Dickson
CAPTAIN ORDNANCE DEPARTMENT, U.S.A.
ASSISTANT
CAPTAIN ORDNANCE DEPARTMENT, U.S.A.
CHIEF, OFFICE OF ORDNANCE, U.S.A.

CLASS 12 | DIVISION 13 | DRAWING 7 | FILE


AZIMUTH POINTER LAMP.
FOR LOCATION SEE M-4-22
EXPANSION HOOKS
PULLEY BLOCK
LENGTH OF CHAIN TO BE DETERMINED BY TRIAL, SO THAT PLUG WILL BE WITHDRAWN AND CIRCUIT BROKEN WHEN MORTAR IS BELOW 43° ELEV.
FIRING CABLE TO BE LEFT SLACK.
STD. THREAD
DETAIL OF HOLES IN RACER, FOR SUPPORTING E253.
TOP OF 6 IN. PIPE, LENGTH TO SUIT. FURNISHED AND SET BY ENG. DEPT.
B.C.P. 110 VOLTS AZIMUTH POINTER
LIGHTING CIRCUIT RECEPTACLE
FIRING CIRCUIT RECEPTACLE
B.C.P. 110 VOLTS QUADRANT
16 C.P. ( ) VOLTS PORTABLE LAMP
WIRING DIAGRAM FOR 110 VOLT MAIN.
LIGHTING CIRCUIT AND FIRING CIRCUIT FROM INLET TO RECEPTACLES ON CARRIAGE TO BE A SLICKED REINFORCED CORD (ENCLOSED TWISTED PAIR, EACH APPROX. 4 CIRCULAR MILS) NEW CODE, TYPE R.W.R. EXTERIOR DRAIN NOT TO EXCEED 'A'.
FIRING CIRCUIT
FROM INLET TO RECEPTACLE ON RACER — 14'-0"
FROM RECEPTACLE ON RACER TO PRIMER — 5'-10"
LIGHTING CIRCUIT.
FROM INLET TO RECEPTACLE ON RACER — 12'-8"
ALL ELECTRIC LIGHTING CABLE, OTHER THAN THE SLICKED CORD SPECIFIED ABOVE, SHALL BE OF THE TWIN CONDUCTOR, LEAD COVERED, STEEL ARMORED TYPE, EACH CONDUCTOR TO BE OF 4000 C.M. AREA (NOM.) THE WHOLE CABLE SHALL BE MADE UP AND TESTED IN ACCORDANCE WITH SPEC. FORM 518, FOR "STANDARD ELECTRICAL CONDUCTORS", DATED JULY 14, 1904.
FROM JUNCTION BOX TO QUADRANT LAMP — 7'-0"
FROM JUNCTION BOX TO AZIMUTH POINTER LAMP — 17'-8"
FROM JUNCTION BOX TO PORTABLE LAMP PLUG BOX — 6'-6"
P37AC
P37AH
P45AH
12 INCH MORTAR CARRIAGE MODEL OF 1896 MII
CABLES AND WIRING DIAGRAMS.
REVISIONS
OCT. 28, 1913.
James L. Wrede
CLASS 12
DIVISION 13
DRAWING 11
FILE

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